Risk of Bias for Epidemiological Studies

Last updated March 28th 2024

Risk of Bias assessments for included cross-sectional studies (1)	Baumgarte[1] 2022 (2)	Gettings[2], 2021 (3)	Granzin[3], 2023 Germany (4)	Monge-Barrio[4] 2021(5)	Oginawati[5], 2022(6)	Pokora[6] 2021(7)	Wessendorf, 2022 (8)
1. Were the criteria for inclusion in the sample clearly defined?	NA	Y	N	U	Y	N	Y
2. Were the study subjects and the setting described in detail?	PY	PY	N	PY	N	PY	Y
3. Was the exposure measured in a valid and reliable way?	N	N	U	PY	U	N	N
4. Were objective, standard criteria used for measurement of the condition?	NA	NA	NA	N	N	NA	Y
5. Were the confounding factors identified?	Y	N	U	N	N	PY	Y
6. Were strategies to deal with confounding factors stated?	PY	N	N	N	N	Y	Y
7. Were the outcomes measured in a valid and reliable way?	N	N	N	N	N	N	Y
8. Was appropriate statistical analysis used?	N	N	N	N	PY	Y	Y
Total score	**3/6**	**2/7**	**0/7**	**2/8**	**2/8**	**4/7**	**7/8**[7]

NA = not applicable; Y = yes; PY = partial yes; PN = partial no; N = no; U = unclear

Risk of bias: 0-2= **Critical**; 3-4= **Serious**; 5-6=Moderate; 7-8= **Low**

[1] considered at risk of bias for confounding and classification/measurement of intervention/exposure
[2] considered at risk of bias for confounding, selection of participants, measurement of exposures and outcomes
[3] considered at risk of bias for confounding and potential selection and measurement bias
[4] considered at risk of bias for measurement of outcomes and confounding was not examined
[5] considered at risk of bias for confounding and potential selection and measurement bias
[6] considered at risk of bias for confounding, selection of participants, measurement of exposures and outcomes
[7] The main concern is the use of a survey to measure exposure since it is an instrument susceptible to information bias.

Risk of Bias assessments for included cohort studies (9)	**Buonanno[8], 2021 (10)**	**Cheng, 2022 (11)**	**Wang[9], 2020 (12)**
Bias due to confounding			
Did the study adjust for other COVID protective interventions (including vaccination)?**	N	N	Y
Did the study adjust for calendar time (implications for circulating variant, season), demographics, and other relevant factors?**	N	N	Y
Were participants free of confirmed COVID infection at the start of the study?**	U	U	U
Bias in selection of participants			
Were both study groups recruited from the same population during the same time period?	Y	N	Y
Were the COVID protective interventions implemented prior to period of data collection? (prevalent users)	Y	N	Y
Were the study groups balanced with respect to participant adherence (based on internal and external factors unrelated to COVID)?	U	U	U
Bias in classification of interventions			
Was the method for confirming the intervention clearly defined and applied consistently across study samples (e.g., districts within a country)?	Y	Y	N
In periods of co-occurring interventions, do the authors clearly classify each individual intervention?	N	NA	Y
Does classification into intervention/control group depend on self-report in a way that might introduce bias?	N	N	Y
For household transmission studies, was it clear that exposure to the index case was the most likely the only exposure to COVID for household or close contacts?	NA	NA	N
Bias due to deviations from intended intervention			
Did the authors assess adherence to the protective behaviours/interventions after intervention implementation?**	NA	N	N
Risk of bias due to missing data			
Was outcome data at the end of the study period available for all or nearly all participants?	U	Y	Y
Were participants excluded due to missing data?	N	N	U
Risk of bias in measurement of outcomes			
Was the outcome of COVID confirmed by laboratory testing?**	U	Y	U
If the outcomes were derived from databases, were the databases constructed specifically for the collection of COVID data?**	Y	U	NA
Were appropriate tools/methods with validated/justified cut-points used to determine outcomes of interest (other than COVID infection/transmission which is covered under laboratory testing)? **	NA	NA	NA
If the outcome was self-reported, did the authors attempt to control for social desirability?**	U	NA	U
Was the frequency of testing for the outcome different between the study groups?	N	U	U
If outcome was observed, was there more than one assessor and if so, was interrater agreement reported?	NA	NA	U

NA = not applicable; Y = yes; PY = partial yes; PN = partial no; N = no; U = unclear

[8] considered at risk of bias for confounding and measurement of outcomes
[9] considered at risk of bias for measurement of exposure, and unclear for measurement of outcome

Risk of Bias assessments for included cohort studies (9)	Wang[10], 2020 (12)	Miyake[11], 2020 (13)	Horve, 2022[12] (14)	Horve, 2022[13] (14)
Bias in selection of study participants:				
Were both study groups recruited from the same population during the same time period?	Moderate	Moderate	Moderate	Moderate
Were the RIDs protective interventions implemented prior to the period of data collection? (Prevalent users)	No information	No information	No information	No information
Were the study groups balanced with respect to participant adherence (based on internal and external factors unrelated to RIDs?	No information	No information	No information	No information
Bias in classification of interventions:				
Was the method for confirming the intervention (e.g., type, setting, dose, frequency, intensity and/or timing of intervention) clearly defined and applied consistently across study samples (e.g., districts within a country)?	Low	Serious	Serious	Low
In periods of co-occurring interventions, do the authors clearly classify each individual intervention?	Low	Serious	Low	Low
Does classification into intervention/control group depend on self-report in a way that might introduce bias?	Moderate	Critical	Critical	Low
For household transmission studies, was it clear that exposure to the index case was the most likely the only exposure to RIDs for household or close contacts?	Moderate	No information	No information	No information
Bias due to confounding:				
Did the study adjust for calendar time (implications for circulating variant, season)?	Critical	Moderate	Moderate	Moderate
Did the study adjust for demographics, prognostic factors and other relevant factors?	Serious	Serious	Moderate	Moderate
Did the study adjust for other RIDs protective interventions (including vaccination)?	Serious	Serious	No information	No information
Were participants free of confirmed RIDs infection at the start of the study?**	Serious	Serious	Low	Low
Bias in measurement of outcomes:				
Was the outcome of RIDs confirmed by laboratory testing?	Serious	Critical	Low	Low
If the outcomes were derived from databases, were the databases constructed specifically for the collection of RIDs data?	No information	No information	Low	Low
Were appropriate tools/methods with validated/justified cut-points used to determine outcomes of interest (other than RIDs infection/transmission which is covered under laboratory testing)?	Critical	Serious	Low	Low
If the outcome was self-reported, did the authors attempt to control for social desirability?	Critical	Critical	Low	Low
Was the frequency of testing for the outcome different between the study groups?	No information	Low	Low	Low
If outcome was observed, was there more than one assessor and if so, was interrater agreement reported?	No information	No information	No information	No information
Bias due to missing data:				
Was outcome data at the end of the study period available for all or nearly all participants?	Low	No information	Low	Low
Were participants excluded due to missing data?	Low	No information	Low	Low
Bias due to deviations from intended intervention:				
Did the authors assess adherence to the protective behaviours/interventions after intervention implementation?	Serious	Serious	Serious	Low
OVERALL	**Critical** [14]	**Critical**[15]	**Critical**[16]	**Moderate**[17]

[10] Participants were recruited from the same city during the same time period of the pandemic. The study relied on self-report for some aspects, such as mask-wearing and disinfection practices within households. The study does not explicitly address the potential for high-risk occupational and social exposures outside of the household setting prior to index case identification. It does not explicitly mention any adjustment for calendar time, demographics, prognostic factors such as socioeconomic status, occupation, or use of other public health and social measures (PHSMs). The study does not explicitly state that all participants underwent laboratory testing. The study relies on telephone interviews, and no mention of efforts to control for social desirability bias.. The study relies on self-reported data through telephone interviews for evaluating the effectiveness of hygiene measures without explicitly verifying adherence to these protective behaviors/interventions.

[11] The participants were quite homogeneous, and the study was conducted during the coldest seasons. Lack of clear classification and detail on how each intervention was handled. Reliance on self-report for classifying individuals into intervention or control groups, without addressing how this potential bias was controlled for. The study adjusted for influenza vaccination; it does not mention controlling for other potential RIDs protective interventions. The validity of the questionnaires used in the present study is unknown. The study does not explicitly mention whether participants were free of confirmed RIDs infection at the start of the study. Outcomes solely dependent on self-report without a validated measure. The study does not mention any attempts to control for social desirability bias and does not mention any verification of adherence to the protective behaviours/interventions after their implementation.

[12] Opening Windows. The status of the windows was taken from a questionnaire (self-report). Citations and mention that symptom and window position results are largely based on self-reported survey data, which may suffer from inconsistencies and misclassification bias. The mention of demographics suggests some level of consideration for confounding factors, but the lack of detail on adjustments for other known important domains indicates a moderate risk.

[13] Intervention evaluation: different air change rates (ACH). The frequency and degree of window opening was self-reported, making it susceptible to information bias in adherence to this intervention

[14] Given that the study is judged to be at a serious risk of bias in at least one domain (bias due to deviations from intended intervention), the overall risk of bias for the study is rated as critical.

[15] This study was susceptible to several biases in the measurement of the intervention, confounding factors, and outcomes, so global risk assessment is critical.

[16] Given that the study is judged to be at a serious risk of bias in at least one domain (risk of bias in the measurement through self-report of the window opening intervention), the overall risk of bias for the study is rated as critical.

[17] Given that the study is judged to be at a moderate risk of bias in at least one domain (measurement and control of confounding factors), the overall risk of bias for the study is rated as moderate.

LES 15.2: Effectiveness of VADF for reducing transmission of RIDs in non-health care community-based settings.

Risk of Bias assessments for included case-control studies (1)	Nabirova, 2022 (15)	Yang, 2021 (16)
1. Were the groups comparable other than the presence of disease in cases or the absence of disease in controls?	PY	Y
2. Were cases and controls matched appropriately?	Y	N
3. Were the same criteria used for identification of cases and controls?	Y	Y
4. Was exposure measured in a standard, valid and reliable way?	U	Y
5. Was exposure measured in the same way for cases and controls?	Y	Y
6. Were the confounding factors identified?	Y	U
7. Were strategies to deal with confounding factors stated?	Y	Y
8. Were outcomes assessed in a standard, valid and reliable way for cases and controls?	Y	N
9. Was the exposure period of interest long enough to be meaningful?	Y	Y
10. Was appropriate statistical analysis used?	Y	Y
Total score	**9/10**[18]	**7/10**[19]

NA = not applicable; Y = yes; N = no; U = unclear

Risk of bias: 0-2= **Critical**; 3-4= **Serious**; 5-7=**Moderate**; 8-10= **Low**

[18] Considered at unclear risk of bias for measurement of exposure

[19] The main concern is due to the method of measuring the outcome, which was a survey and from this the comparison groups were defined. The comparators in this study were the "case" and "control" bedrooms, differentiated by the incidence of respiratory infections among their occupants. “Case” dormitories had at least one occupant reporting an annual infection incidence ≥6-times, while “control” dormitories had all occupants with an annual infection incidence <6-times. Some confounding factors were measured through the survey, but other relevant ones such as vaccination or time spent in the rooms

Risk of Bias assessments for included quasi-experimental studies (1)	Falkenberg, 2023 (17)
Is it clear in the study what is the 'cause' and what is the 'effect' (i.e. there is no confusion about which variable comes first)?	Y
Were the participants included in any comparisons similar?	Y
Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?	N
Was there a control group?	Y
Were there multiple measurements of the outcome both pre and post the intervention/exposure?	N
Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analyzed?	U
Were the outcomes of participants included in any comparisons measured in the same way?	Y
Were outcomes measured in a reliable way?	Y
Was appropriate statistical analysis used?	Y
Total score	**6/9**[20]

NA = not applicable; Y = yes; N = no; U = unclear

Risk of bias: 0-2= **Critical**; 3-4= **Serious**; 5-7=**Moderate**; 8-9= **Low**

[20] The main concern arises that participants in the comparisons were not receiving similar treatment/care, other than the exposure or intervention of interest (HEPA filters). This discrepancy could introduce confounding variables, affecting the study's ability to isolate the effect of HEPA filters on COVID-19 transmission rates. If kindergartens implemented various additional preventive measures (e.g., mask use, ventilation practices, surface decontamination) inconsistently between the intervention and control groups, these differences could influence the outcome regardless of the filters. HEPA. Such variations in treatment/care could potentially bias results, making it difficult to attribute changes in COVID-19 transmission rates directly to the use of HEPA filters.

Risk of Bias assessments for included randomized crossover trials studies (18)		Myers, 2022 (19)
Domain 1a: Risk of bias arising from the randomization process		
Signalling questions	**Response options**	
1.1 Was the allocation sequence random?	Y/PY/PN/N/NI	Y
1.2 Was the allocation sequence concealed until participants were enrolled and assigned to interventions?	Y/PY/PN/N/NI	Y
1.3 Did baseline differences between intervention groups at the start of the first period suggest a problem with the randomization process?	Y/PY/PN/N/NI	Y
Risk-of-bias judgement	Low / High / Some concerns	Some concerns
Domain S: Risk of bias arising from period and carryover effects		
Signalling questions	**Response options**	
S.1 Was the number of participants allocated to each of the two sequences equal or nearly equal?	Y/PY/PN/N/NI	Y
S.2 If N/PN/NI to S.1: Were period effects accounted for in the analysis?	NA/Y/PY/PN/N/NI	NA
S.3 Was there sufficient time for any carryover effects to have disappeared before outcome assessment in the second period?	Y/PY/PN/N/NI	N
Risk-of-bias judgement	Low / High / Some concerns	Some concerns
Domain 2: Risk of bias due to deviations from the intended interventions (*effect of assignment to intervention*)		
Signalling questions	**Response options**	
2.1. Were participants aware of their assigned intervention during each period of the trial?	Y/PY/PN/N/NI	N
2.2. Were carers and people delivering the interventions aware of participants' assigned intervention during each period of the trial?	Y/PY/PN/N/NI	PN
2.3. If Y/PY/NI to 2.1 or 2.2: Were there deviations from the intended intervention that arose because of the trial context?	NA/Y/PY/PN/N/NI	NA
2.4 If Y/PY to 2.3: Were these deviations likely to have affected the outcome?	NA/Y/PY/PN/N/NI	NA
2.5. If Y/PY/NI to 2.4: Were these deviations from intended intervention balanced between groups?	NA/Y/PY/PN/N/NI	NA
2.6 Was an appropriate analysis used to estimate the effect of assignment to intervention?	Y/PY/PN/N/NI	PN
2.7 If N/PN/NI to 2.6: Was there potential for a substantial impact (on the result) of the failure to analyse participants in the group to which they were randomized?	NA/Y/PY/PN/N/NI	Y
Risk-of-bias judgement	Low / High / Some concerns	High
Domain 3: Risk of bias due to missing outcome data		
Signalling questions	**Response options**	
3.1 Were data for this outcome available for all, or nearly all, participants randomized?	Y/PY/PN/N/NI	N
3.2 If N/PN/NI to 3.1: Is there evidence that the result was not biased by missing outcome data?	NA/Y/PY/PN/N	N
3.3 If N/PN to 3.2 Could missingness in the outcome depend on its true value?	NA/Y/PY/PN/N/NI	PY
3.4 If Y/PY/NI to 3.3: Is it likely that missingness in the outcome depended on its true value?	NA/Y/PY/PN/N/NI	NI
Risk-of-bias judgement	Low / High / Some concerns	High
Domain 4: Risk of bias in measurement of the outcome		
Signalling questions	**Response options**	
4.1 Was the method of measuring the outcome inappropriate?	Y/PY/PN/N/NI	PN
4.2 Could measurement or ascertainment of the outcome have differed between interventions within each sequence?	Y/PY/PN/N/NI	PN
4.3 If N/PN/NI to 4.1 and 4.2: Were outcome assessors aware of the intervention received by study participants?	NA/Y/PY/PN/N/NI	PY
4.4 If Y/PY/NI to 4.3: Could assessment of the outcome have been influenced by knowledge of intervention received?	NA/Y/PY/PN/N/NI	N
4.5 If Y/PY/NI to 4.4: Is it likely that assessment of the outcome was influenced by knowledge of intervention received?	NA/Y/PY/PN/N/NI	PN
Risk-of-bias judgement	Low / High / Some concerns	Low
Domain 5: Risk of bias in selection of the reported result		
Signalling questions	**Response options**	
5.1 Were the data that produced this result analyzed in accordance with a pre-specified analysis plan that was finalized before unblinded outcome data were available for analysis?	Y/PY/PN/N/NI	NI

Is the numerical result being assessed likely to have been selected, on the basis of the results, from... 5.2. multiple eligible outcome measurements (e.g. scales, definitions, time points) within the outcome domain?	Y/PY/PN/N/NI	PN
5.3 ... multiple eligible analyses of the data?	Y/PY/PN/N/NI	PN
5.4 Is a result based on data from both periods sought, but unavailable on the basis of carryover having been identified?	Y/PY/PN/N/NI	PY
Risk-of-bias judgement	Low / High / Some concerns	High
Overall risk of bias		
Risk-of-bias judgement	Low / High / Some concerns	**High**[21]

NA = not applicable; Y = yes; PY = partial yes; PN = partial no; N = no; NI= No information

[21] The study is judged to be at high risk of bias in at least one domain for this result. In this study, the main concerns are about the very small sample size, the reporting of an imputed case, multiple uncontrolled confounding factors and no statistical adjustment, data with which the new period begins is not reported, the results are grouped and there is no washing time.

Modelling Studies: Adequacy of the model, applicability and transparency in reporting

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Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
Aganovic et al., 2022 (20)	The description of the population and the interventions evaluated in the study appears to be indirectly provided through the focus on indoor environments and the assessment of different ventilation systems' impact on the airborne transmission risk of SARS-CoV-2. However, specific details about the population, such as the number of individuals, their health status, or behaviors that might affect transmission risk, are not explicitly mentioned. This omission is understandable given the study's primary focus on environmental factors and theoretical modeling rather than on direct human subjects.	The description of the model used in the study appears to be complete and appropriate. The authors have detailed the extension of the Wells-Riley model to account for different ventilation systems and their impact on airborne infection risk. They have introduced a zonal modeling approach that divides enclosed spaces into zones with uniform mixed air, which is a significant adaptation from the traditional Wells-Riley model that assumes well-mixed room air.	The authors have published the assumptions of their model, acknowledging the limitations inherent in their approach. They explicitly state that their model applies only to long-distance airborne transmission of SARS-CoV-2, excluding short-range transmission. Additionally, they note the omission of convective flows within the space caused by thermal sources, such as human thermal plumes, which could affect the flow field.	The study provides the formulas associated with the model, detailing the differential equations for the change in quanta concentrations in different zones of the ventilation systems.	The results and conclusions presented by the authors are consistent with the methodology and the assumptions of their model. They have utilized the developed zonal model to demonstrate the impact of different airflow distribution methods on infection risk, which aligns with their objective to provide a more accurate assessment of airborne infection risk in environments with advanced ventilation systems.	**Moderate**
Aganovic et al., 2022 (21)	While the methodology employed in the study is sound for assessing the impact of humidity and ventilation on airborne virus transmission, the description of the population and interventions could be improved by providing more detailed information on the study conditions.	The description of the model used in the study appears to be complete and appropriate for assessing the impact of indoor relative humidity (RH) and ventilation rates on the infection risk of various respiratory airborne viruses. The study employs a modified Wells-Riley (WR) model that incorporates additional removal mechanisms such as gravitational settling, virus inactivation, and respiratory tract absorption, beyond the	The authors have clearly published the assumptions underlying their model. These include the constant emission rate of virus quanta from an infected individual, the consideration of four removal mechanisms (ventilation, virus inactivation, deposition by gravitational settling, and respiratory absorption), and the impact of RH on these mechanisms.	The study provides detailed formulas for calculating the deposition rate of virus-laden droplets, the gravitational settling velocity, and the total deposition number as a function of droplet diameter and tidal volume size. Some formulas are detailed in the supplementary material to which you have access.	The results and conclusions presented by the authors seem consistent with the methodology and analyses employed in the study. They demonstrate how varying RH and ventilation rates can significantly impact the infection risk for different viruses, with the effect of RH being dependent on the virus type, exposure time, and ventilation rate. The study's conclusions are supported by the model's outcomes,	**Moderate**

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
		conventional ventilation removal mechanism.			indicating a robust analytical approach.	
Aganovic et al., 2021 (22)	While the study focuses on a classroom setting for its simulations, there is no detailed information about the specific characteristics of the population involved, such as age, health status, or density of individuals in the room. The interventions evaluated, namely changes in ventilation rates and relative humidity levels, are adequately described in terms of their potential impact on infection risk.	The description of the model used in the study is comprehensive and appropriate for evaluating airborne transmission dynamics of infectious diseases in confined spaces. The model is based on the Wells-Riley model. It incorporates the concept of 'quantum of infection' and considers both source and sink terms, including steady-state quanta generation and removal by ventilation. Modifications to incorporate non-steady-state quanta levels and additional removal mechanisms like biological decay and deposition loss have been discussed.	The study has published several key assumptions of the model. These include the assumption of well-mixed room air, steady-state quanta generation, and constant ventilation rate for quanta removal. It also acknowledges the limitations of these assumptions, such as the immediate dilution of expelled virus concentration and the challenge of achieving complete mixing within a space.	The study provides formulas related to the model, such as the expression for the deposition rate of virus-laden droplets. However, the detailed mathematical framework encompassing all aspects of the modified Wells-Riley model, including non-steady-state conditions and additional removal mechanisms, is not fully described in the provided excerpts.	The study acknowledges limitations related to the assumptions of well-mixed air and immediate dilution of expelled virus concentration, which could affect the accuracy of the model's predictions. Despite these limitations, the study's use of the Wells-Riley model and its modifications for evaluating airborne transmission risks in indoor environments is consistent with established practices in the field.	**Moderate**
Arpino et al., 2022 (23)	The description of the population and the interventions evaluated in the study appears to be adequately detailed for the purpose of assessing the risk of SARS-CoV-2 Delta variant transmission in car cabins. However, the summary does not specify the demographic characteristics of the population (e.g., age, health status) which could influence susceptibility to infection and might be relevant for a more detailed risk assessment. The interventions evaluated, particularly the	The description of the model used in the study is comprehensive and appropriate for the objectives set forth. The authors employed a transient non-isothermal 3D Eulerian-Lagrangian numerical model, which was developed and validated in previous research, to describe particle spread once emitted by an infected speaking/breathing passenger located in a car cabin compartment. This model is based on the open-source OpenFOAM software, allowing for a fully open and flexible tool with complete control of the variables	The study clearly outlines several assumptions made within the model. For instance, particle collisions were considered elastic, and the effect of the particles on the airflow was deemed negligible, assuming a one-way coupling between the continuum phase and the discrete phase. Additionally, the simulations assumed winter climatic conditions, with specific temperatures set for the car windows, inlet air, and passenger face temperatures. It was also assumed that people in the car cabin would wear winter clothes, and thus, the body	The summary does not provide explicit details on the specific formulas associated with the model, such as the governing Partial Differential Equations (PDEs) for airflow, pressure, and temperature fields, or the equations for particle motion. However, it mentions that the airflow (continuous phase) and Newton's equation of motion for each particle (discrete phase) were solved, and turbulence was modeled using the Unsteady Reynolds Averaged Navier Stokes (URANS) approach with the Shear Stress Transport (SST) k–ω model. While the exact formulas are not detailed, references to the scientific literature and previous research activities that validated these approaches are provided, suggesting	The results and conclusions drawn by the authors seem consistent with the objectives and methodology of the study. The results, including the distribution of secondary cases and the probability of infection under different scenarios, were consistent with the model's capabilities and assumptions. The authors also acknowledged the limitations and specific conditions of their study, such as the exclusion of mitigation measures like masks and vaccination, and the unique configuration of the car cabin used in their simulations.	**Moderate**

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
	different ventilation modes and airflow rates, are well-chosen as they represent practical measures that can be manipulated in real-world scenarios to mitigate the risk of airborne transmission of viruses. The inclusion of different expiratory activities (breathing and speaking) as variables also adds to the study's relevance.	employed for particle dispersion assessment. The model incorporates various influence parameters such as the position of the infected subject within the car cabin, airflow rate of the HVAC system, HVAC ventilation mode, and expiratory activity.	temperature plume was neglected.	that these foundational aspects of the model are well-established in the field.		
Azimi, 2020(24)	The population under study is clearly defined as students in various U.S. school settings, with considerations for factors such as age and vaccination status. The interventions evaluated, are well-chosen as they represent practical measures that can be implemented in school environments to reduce the risk of measles transmission.	The description of the model used in the study is both complete and appropriate. The authors developed a nationwide representative School Building Archetype (SBA) model combined with a transient multi-zone Wells-Riley model to estimate the transmission risk of measles in U.S. schools. The methodology incorporates back-calculation of quanta generation rates from actual epidemiological studies and considers the variability in school settings and HVAC systems across the nation.	The study published its assumptions, including simplifications made in developing the transient Wells-Riley model, such as assuming continuous stay of students in microenvironments, constant number of students, and a simplified format of student interactions.	The study provides the formula used to define infection risk. Detailed mathematical expressions and specific derivations of the Wells-Riley multizone transient approach and the process for calculating quanta generation rates are provided in the supplementary material.	The results and conclusions of the authors appear to be consistent with the methodology and objectives of the study. The combination of the SBA and transient multi-zone Wells-Riley models estimates the nationwide infection risk of measles within the range of first-generation transmission rates of measles in schools, as per existing epidemiological studies.	**High**
Barone, 2022 (25)	The description of the population and the interventions to be evaluated, is not explicitly detailed. While the methodology for assessing both energy performance and infection risk is well outlined, there is a lack of specific information regarding the characteristics of the	The description of the model used for assessing both the train energy performance and the probability of infection among passengers appears to be complete and appropriate. The methodology integrates a detailed simulation model managed by a Matlab script, which handles inputs and outputs related to the railway coach energy simulation and	The Wells-Riley model application is mentioned, and some parameters are listed, but specific assumptions regarding passenger behavior, mask usage rate, or ventilation effectiveness are not fully elaborated.	The formulas associated with both the energy consumption and the Covid-19 contagion risk assessment are published and described.	The results and conclusions of the authors appear to be consistent with the methodology and objectives outlined in their study. The study's outcomes underline the necessity of updating ventilation standards in enclosed spaces, highlighting the balance between reducing CO2 concentration and Covid-19 contagion risk	**Moderate**

LES 15.2: Effectiveness of VADF for reducing transmission of RIDs in non-health care community-based settings.

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
	population (e.g., number of passengers, demographics) and the precise interventions (e.g., specific ventilation rates, filtration systems) being evaluated. The case study mentioned involves a high-capacity double-deck train carriage operating on regional bases, but further details on the interventions and the population characteristics within this context are not provided.	the infection risk calculation model. The energy simulation is based on the coupling of Building Information Modelling (BIM) software with a dynamic energy simulation tool. For the contagion risk assessment, the Wells-Riley infection model is applied.			against the backdrop of increased energy consumption. The recommendation to adopt heat recovery devices to mitigate the energy and economic implications further aligns with the study's comprehensive approach to addressing both IAQ and energy efficiency in the context of the Covid-19 pandemic.	
Cai et al., 2022	The population under study is clearly defined as over 100,000 public and private schools across the U.S., providing a broad and representative sample for assessing the impact of COVID-19 mitigation strategies on energy costs. The inclusion of both public and private schools allows for a comparison of costs across different types of educational institutions, which is valuable for stakeholders and policymakers. The interventions evaluated, including improved ventilation, air filtration, and partial online learning, are relevant and practical measures for reducing airborne infection risks in schools. locations.	The description of the model used in the study appears to be both complete and appropriate for the objectives of the research. The methodology encompasses a comprehensive approach, including epidemiological scenario generation, energy consumption estimation of school HVAC systems, infection risk modeling, and energy cost modeling. The study also considers the impact of climate change on energy costs, which adds depth to the analysis. The use of EnergyPlus for building energy simulation and the division of the U.S. into 16 climate zones for building energy simulation are particularly noteworthy, indicating a detailed and tailored approach to modeling.	The authors have published several key assumptions of their model. These include the use of electricity for indoor cooling and fan operation, natural gas for heating, the simplification of schools as one-story buildings, and the viral load in sputum for infection risk modeling. Additionally, the study assumes a well-mixed condition within the school environment for the estimation of indoor airborne transmission. While these assumptions are critical for the model's development and application, it's unclear if all assumptions have been disclosed, especially those related to the epidemiological aspects and specific HVAC system characteristics.	The study has published key formulas associated with the model, particularly for infection risk modeling and energy cost estimation. The formula for calculating the infection risk based on viral load, conversion factor, pulmonary ventilation rate, and droplet concentration is provided. Additionally, the methodology for estimating energy costs, which involves calculating energy consumption and then combining this with local utility prices, is outlined. These formulas are essential for replicating the study's findings and understanding the basis of the model's predictions.	The results and conclusions presented by the authors appear to be consistent with the objectives and findings of their study. The authors have effectively demonstrated the relationship between energy costs and health outcomes under different scenarios, including the impacts of air filtration and online learning on energy costs. The study's limitations are acknowledged, including the simplification of schools as one-story buildings and the assumption of a well-mixed condition within the school environment for the estimation of indoor airborne transmission.	**Moderate**
Clements et al., 2023 (26)	The description of the population and the	The description of the model used across the cited studies	The studies acknowledge and publish the assumptions	The article provides specific formulas associated with the model, such as the	The results and conclusions presented in the studies are	**High**

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
	interventions evaluated appears to be adequately detailed for the purpose of the study.	appears to be complete and appropriate for the objectives of the research. The studies detail the use of a tracer-scaled bulk aerosol Quantitative Microbial Risk Assessment (QMRA) model, incorporating parameters for pathogen emission, risk, tracer emission, and tracer-scaled pathogen dose and risk models. Monte Carlo simulation is employed for model evaluation and sensitivity analysis, indicating a comprehensive approach to understanding the dynamics of aerosolized pathogens in indoor environments.	of the model, including the limitations of treating aerosols as a bulk substance and the potential discrepancies in bulk aerosol removal estimates due to differential removal of larger aerosol particles. Assumptions regarding the transport of respiratory aerosols being consistent with tracer transport and the use of impulse modes of respiratory emission are also disclosed.	equation modeling the concentration of aerosolized pathogens from a cough or sneeze in a perfectly mixed room and the relative risk (RR) comparison formula.	consistent with the methodologies and objectives outlined. The use of DNA tracer decay testing to evaluate the effectiveness of a HEPA air cleaner, and the scenario testing to assess the impact of interventions like ventilation and masking, lead to conclusions that are logically derived from the data and analyses conducted. The acknowledgment of the model's limitations and the potential for more complex modeling schemes to improve accuracy further supports the consistency and reliability of the authors' conclusions.	
Corzo et al., 2022 (27)	The study does not explicitly detail the population characteristics within the bus, such as the number of passengers, their distribution, or potential sources of virus emission (e.g., coughing or talking passengers). Understanding that the primary focus is on the environmental conditions and their impact on virus transmission, the lack of specific population details might be considered adequate for the study's computational and analytical modeling approach. However, incorporating more detailed passenger scenarios could enhance	The description of the model used in the study is both complete and appropriate for the objectives set by the authors. The model incorporates various scenarios, including different states of window openness and HVAC operation modes, to simulate the ventilation and virus propagation in an urban bus. The scenarios are clearly defined as Case 1 (all windows closed and HVAC off), Case 2 (all windows closed and HVAC on with full air recirculation), Case 3 (all windows closed and HVAC on with partial air recirculation), and Case 4 (six windows opened, HVAC off). The model also accounts for twenty seated occupants,	The study published several key assumptions of the model. It assumes a specific number of windows can be opened, providing a total opening area, and bases the effectiveness of window opening on previous studies. The model also assumes a specific breathing cycle for the occupants and employs a unique tracer variable for each emitter to track the virus transmission.	The study provides formulas associated with the model, particularly in the context of risk estimation and the tracking of virus transmission. For instance, it mentions the use of a zero-dimensional Wells–Riley (0D WR) model for risk estimation and outlines the formula for calculating the average concentrations of tracer at the inlet and outlet vents, considering the recirculation ratio and the efficiency of the filters. However, while some formulas are mentioned, the detailed mathematical framework of the 0D WR model and its application to the different scenarios could be more explicitly detailed to enhance the clarity of the methodology.	The results and conclusions presented by the authors are consistent with the objectives and methodology of the study. The study aimed to investigate the impact of different ventilation strategies on virus propagation in an urban bus, employing computational fluid dynamics (CFD) simulations and the Wells–Riley model for risk estimation. The authors concluded that while opening windows ensured negligible transmission risk, it might not always be feasible under extreme weather conditions. The study also highlighted the discrepancy between the 0D Wells–Riley model estimations and CFD results	**Moderate**

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
	the realism and applicability of the findings. The interventions evaluated in the study are well-defined and relevant to public health guidelines and practical measures that can be implemented in public transportation settings.	including the driver and nineteen commuters, adhering to capacity restrictions imposed by the government, and specifies the location of ten emitters among the passengers.			in cases of motionless airflow and open windows, indicating higher local risks than average ones in these scenarios.	
Cotman et al., 2021 (28)	The study specifically focuses on office buildings and social gatherings. The inclusion of various factors such as air changes per hour, population size, residence time, and the specifics of HVAC system performance (filtration efficiency, UV filtration, and in-room filtration units) provides a comprehensive framework for evaluating the impact of different interventions. However, the study could enhance its description by providing more details about the demographic characteristics of the population (e.g., age, health status) and their behavior (e.g., compliance with mask-wearing, social distancing) as these factors can significantly influence transmission dynamics. Additionally, while the interventions evaluated are relevant and important, the	The description of the model used in the study is comprehensive and appropriate for the objective of simulating SARS-CoV-2 transmission via HVAC systems in indoor environments. The model incorporates key parameters such as particle size, infectious dose, and probit slope for dose-response, which are critical for assessing the risk of infection. It also includes detailed HVAC system parameters like air changes per hour (ACH), fraction of outside air (FOA), and filter efficiency, alongside the effects of ultraviolet light (UVC) decontamination and portable in-room filtration units. The use of Monte Carlo sampling to model individual group behaviors and the probit dose-response model for calculating infection probabilities further adds to the model's robustness.	The study outlines several assumptions inherent in the model, such as the use of SARS-CoV-1 median infectious dose as a surrogate for SARS-CoV-2, and the probit model slope derived from SARS-CoV-1 data. It also assumes a continuous point source of aerosol generation by an infected emitter and models aerosol transport with dependencies on particle size for filtration and settling rates. While these assumptions are critical for the model's operation, the study could potentially benefit from a more explicit discussion on the assumptions regarding human behavior and compliance with interventions, which are less clearly stated.	The study provides key formulas associated with the model, including the probit dose-response model. It also details the mechanics of aerosol transport, including generation, mixing, filtration, and biological decay.	The results and conclusions presented in the study appear to be consistent with the methodology and findings. The study effectively uses its model to evaluate the impact of various interventions on the transmission of SARS-CoV-2 in indoor environments, providing insights into the relative effectiveness of increasing air changes per hour (ACH), enhancing filtration efficiency, and augmenting the fraction of outside air (FOA) in reducing transmission rates. The study acknowledges that while these HVAC modifications can significantly mitigate the risk of SARS-CoV-2 transmission, they cannot reduce the risk to zero, especially in scenarios with high aerosol emission rates. This conclusion is supported by the detailed simulation results across different settings, including office buildings and social venues,	**Moderate**

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
	study could also consider the cumulative effect of combining multiple interventions simultaneously, as this would reflect more realistic mitigation strategies.				which consistently show that increasing ACH is the most impactful mitigation measure, particularly at low aerosol emission rates, with diminishing returns observed as interventions are tuned for mitigation.	
Das et al., 2023 (29)	The population in this context refers to the environmental conditions within passenger railcars, which are representative of public transportation settings. The interventions evaluated are well-chosen and relevant to the study's objectives. However, the study could be enhanced by providing more detailed information about the specific models of air purifiers used, the exact settings for air recirculation ratios, and how these interventions might be scaled or adapted in different types of passenger railcars or other public transportation settings. Additionally, information on the occupancy levels during the experiments and how they might affect aerosol concentrations and removal rates.	The description of the model used in the study appears to be both complete and appropriate for the objectives of the research. The study employed multilevel mixed-effects linear regression models with random intercepts to assess the impact of various engineering controls (damper position, filter type, and air purifier use) on aerosol removal rates under both static and dynamic conditions. This approach is suitable for analyzing the effects of different interventions on particle removal rates, considering the variability introduced by different experimental conditions and the inherent randomness in aerosol distribution and removal processes.	The authors published all the major assumptions of their model, which include the absence of prior infectious material in the car before the trip begins, the latent period of the disease being longer than the length of the model, the even distribution of infectious aerosols throughout the cabin volume, and the removal of infectious aerosols by a first-order process that includes ventilation, deposition, and viral inactivation. These assumptions are critical for understanding the context in which the model's results are valid and interpreting the findings accurately.	The study provided formulas associated with the model, such as the equation used to estimate particle removal rates when using a HEPA air purifier at different settings, and the equation to estimate the particle removal rates for different conditions based on the recirculation ratio, MERV filter rating, and the presence of an air purifier. These formulas are essential for replicating the study's findings and applying the model to similar scenarios in other research contexts.	The results and conclusions presented by the authors are consistent with the methodology and analysis described. The study found significant differences in aerosol removal rates based on the engineering control type used, with specific coefficients provided for different aerosol size ranges under both static and dynamic conditions. The study concluded that the use of a portable HEPA air purifier did not significantly affect removal rates, which is consistent with the results obtained from the mixed-effects linear regression model.	**Moderate**

LES 15.2: Effectiveness of VADF for reducing transmission of RIDs in non-health care community-based settings.

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
Das, 2021(30)	While the equation used for estimating health outcomes indicates a focus on the affected population and changes in air quality, specific details about the population characteristics (e.g., age, health status, location) or the precise nature of the interventions evaluated (beyond general references to changes in air quality and lockdown strategies) are not provided.	The description of the model used in the study appears to be complete and appropriate for the objectives of the research. The study employs a COVID airborne infection risk estimator model, which incorporates various input parameters such as volume, air changes per hour (ACH), mask efficiency for emission and intake, and dimensions of different vehicles like AC taxis, non-AC taxis, buses, and autorickshaws. The model also utilizes regression models for estimating ACH in different scenarios.	The study published the assumptions of the model, including the distributions and ranges used for each scenario. For instance, it specifies uniform distributions for ACH and mask efficiencies, and it provides the dimensions of vehicles and estimated air volumes, which are critical for calculating the air exchange rates and subsequently, the infection risks.	The study does not explicitly detail the formulas used within the COVID airborne infection risk estimator model in the provided excerpts. However, it references the use of an equation developed by Fann et al. (2012) for estimating annual adverse health outcomes, which is related to air quality changes but not directly to the COVID infection risk model.	The results indicate that AC taxis have a significantly higher probability of infection compared to non-AC taxis, buses, and autorickshaws, with the probability of infection decreasing as vehicle speed increases. These findings are consistent with the model's focus on air exchange rates and mask efficiencies as critical factors in infection risk. The conclusions drawn from these results, align with the model's parameters and the observed data.	**Moderate**
Dong et al., 2022 (31)	The population focus is on a kindergarten building. The interventions evaluated, namely the optimization of building openings' design parameters, are well-defined and relevant to the study's goals. However, the study could benefit from a more detailed description of the demographic characteristics of the population (e.g., age range of children, staff-to-child ratio) and how these might influence the generalizability of the findings.	The description of the model used in the study appears to be complete and appropriate. The authors have detailed the integration of the Wells-Riley model with Computational Fluid Dynamics (CFD) for the optimization of building design parameters to reduce indoor virus infection rates. They have utilized parametric programming techniques to interface these models with an evolutionary algorithm, aiming to optimize the geometric variables of building openings.	The study does publish some of the assumptions of the model, particularly regarding the simplification of variables used in the infection rate calculation. It acknowledges that in real-life situations, these variables are constantly changing dynamically, and for the purpose of the study, they have been simplified. This simplification is justified by the study's focus on exploring the changing trend of infection rates rather than determining precise infection rates for medical prediction. However, the study also mentions limitations related to not accounting for the specific activity trajectories of infected and exposed individuals due to the	The study mentions the use of the Wells-Riley equation, which is a fundamental part of their model integration for assessing virus infection rates. However, the specific formulas associated with the CFD model, the genetic algorithm, and how these are integrated with the Wells-Riley model are not detailed in the provided excerpts. While there is a mention of the operational models and the theoretical framework, the lack of explicit formulas or mathematical expressions in the provided text suggests that this aspect could be more comprehensively covered.	The study concludes with the potential of the approach introduced for optimizing building design to reduce indoor virus infection rates, acknowledging the shortcomings and areas for improvement. The authors have demonstrated the effectiveness of building design optimization through their model, which suggests a consistency in their results and conclusions. They acknowledge the limitations of current research models and propose their model as an advancement in linking geometric optimization with viral infection rate calculations.	**Moderate**

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
			random nature of population activity, which could affect the experimental results.			
Farthing, 2021 (32)	The description of the population and the interventions to be evaluated appears to be adequately detailed. The population is based on a real-world event with 61 attendees, one of whom was symptomatic and likely led to 53 secondary infections. The interventions are clearly defined, with mask efficacy levels ranging from 0% to 90%, reflecting different types of masks and their expected performance.	The description of the model appears to be both complete and appropriate. The authors developed a spatially explicit, stochastic agent-based model (ABM) to simulate direct-droplet and airborne respiratory pathogen transmission in indoor settings. This model incorporates the dynamics of droplet size, diffusion, and decay, as well as the movement and positioning of individuals within a room. The use of the NetLogo modeling software and the detailed description provided in Supplemental Materials support the comprehensiveness.	The authors have published the assumptions of the model. They clearly state the use of the term "droplet" to refer to respiratory droplets of any size and describe the assumptions related to droplet dynamics, including expulsion, inhalation, fallout, diffusion, and decay. Additionally, the assumption that no individuals exceed pathogen latent or infectious periods due to the limited duration of simulations is explicitly mentioned.	Supplementary material details the formulas and equations associated with droplet dynamics, infection risk, and intervention effectiveness. In Supplement 1 there are equations that calculate the number of virions, the probability of infection, and the effect of population density. Supplement 2 explains how linear regression is performed to relate the percentage of susceptible infected individuals to virion risk.	The results and conclusions presented by the authors seem consistent with the methodology and analyses employed. They utilized a well-documented superspreading event as a case scenario to benchmark their model and assess the efficacy of various nonpharmaceutical interventions in reducing transmission risk. The use of 1,080,000 simulations and a beta regression model to estimate intervention effects supports the robustness of their findings. The conclusions drawn regarding the potential effectiveness of interventions like mask usage, increased airflow, and limiting contact durations are logically consistent with the model's design and the analyses conducted.	**High**
Faulkner, 2021(33)	The population in focus is the occupants of a medium office building. The interventions evaluated—different HVAC filtration strategies and the use of 100% outdoor air—are pertinent. However, the paper could enhance its methodology section by providing more detailed demographic	The description of the model used in the study appears to be both complete and appropriate. The model is divided into four sections: multizone airflow including virus generation and decay, the Variable Air Volume (VAV) system model, the control system, and weather conditions. The inclusion of virus generation and decay rates, alongside the HVAC	The study does publish its assumptions, particularly in the development of new models for HVAC filters and virus transmission. For instance, the HVAC filter model assumes a certain efficiency in virus removal and a static pressure drop depending on the mass flow rate and defined nominal flow conditions. Additionally, the virus	The study provides specific formulas associated with the model, particularly in the description of the HVAC filter model where the formula for virus concentration exiting the filter is given.	The results and conclusions of the authors seem consistent with the methodology employed and the assumptions made. The study's approach to modeling and its detailed analysis of HVAC operation strategies in reducing the risk of airborne virus transmission are well-supported by the developed models and the formulas used.	**Moderate**

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
	information about the building occupants. Additionally, a more thorough explanation of the criteria for selecting the specific HVAC strategies for evaluation.	and control system models, ensures that the study can accurately simulate real-world scenarios. The use of Modelica for developing these models further supports the appropriateness of the methodology.	generation model assumes the presence of a "sick" person in each zone, with quanta emission rates based on literature.			
Feng, 2023(34)	The description of the population and the interventions evaluated in the study appears to be adequately detailed for the purpose of assessing COVID-19 transmission risks in UPT settings. The inclusion of different UPT modes (buses, subways, high-speed trains) and the consideration of various respiratory activities provide a comprehensive view of potential transmission scenarios. The interventions evaluated, including mask-wearing, ventilation improvements, and social distancing, are pertinent.	The description of the model used in the study appears to be complete and appropriate for evaluating short-range and room-scale risks in urban public transport (UPT) settings such as buses, subways, and high-speed trains. The methodology integrates field measurements with a COVID-19 risk assessment model, employing equations to estimate ventilation rates based on CO2 concentrations and other factors. The use of the TJWR model to calculate individual and room-scale infection probabilities further supports the appropriateness of the model.	The study published the assumptions of the model, including the constant number of the index case, the exposure duration, and the infectious virus removal rate attributed to air changes per hour (ACH), deposition rate, and virus inactivation rate.	The study published the formulas associated with the model, providing a detailed mathematical framework for estimating ventilation rates, calculating the quanta concentration at the inhalation position, and determining individual and room-scale infection probabilities.	The results and conclusions of the study appear to be consistent with the methodology and findings. The conclusions are supported by the data and analyses presented, including the impact of ACH on risk assessments and the evaluation of high-occupancy scenarios.	**High**
Foat et al., 2022 (35)	The description of the population and interventions in the study appears to be focused on a hypothetical scenario rather than a specific, real-world population. The "population" in this context refers to the simulated presence of an infected individual (or individuals) within a mechanically ventilated	The description of the model used in the study appears to be complete and appropriate for the objectives outlined. The study employs a computational fluid dynamics (CFD) model using an unsteady Reynolds-averaged Navier-Stokes (RANS) approach, coupled with a Lagrangian phase for the exhaled droplets. The methodology, geometry, and	While the study mentions the validation of the model against experimental data and the sensitivity analyses conducted, it does not explicitly detail all the assumptions made within the model. However, it is implied that assumptions regarding droplet size distribution, airflow patterns, and droplet evaporation rates under	The excerpts provided do not explicitly mention the publication of specific formulas associated with the computational fluid dynamics (CFD) model used in the study.	The results and conclusions presented by the authors seem consistent with the objectives and methodology of the study. The findings on the interdependency between temperature, relative humidity, and droplet dispersion are supported by statistical analysis. The use of quantile regression models and the acknowledgment of significant interactions	**Moderate**

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
	meeting room, emitting respiratory droplets through coughing. The interventions evaluated include adjustments to the room's temperature and humidity levels to understand their impact on the dispersion of respiratory droplets and the potential exposure of others in the room to viral particles.	mesh were based on previous validated models.	different environmental conditions were integral to the model's development. The study acknowledges the variability in droplet size distribution and the potential impact of measurement instruments on these distributions.		between temperature and RH further support the rigor and consistency of the study's conclusions.	
Foster, 2021 (36)	The description of the population in the study is adequately detailed for its objectives. The interventions evaluated in the study are well-chosen and reflect a comprehensive approach to mitigating the spread of COVID-19 in indoor settings.	The description of the model employed in the study is both complete and appropriate for the objectives set. The study utilizes computational fluid dynamics (CFD) simulations to evaluate the transmission of SARS-CoV-2 in classroom settings, incorporating a quanta-dispersion equation (QDE) to model the advection of viral-particle concentration. This approach is based on a finite-volume method within a commercial CFD code, Star CCM+. The methodology includes detailed considerations of classroom configurations, ventilation systems, and the effectiveness of various mitigation strategies such as face coverings, ventilation improvements, and air purifiers.	The authors have published the assumptions underlying their model. These assumptions include the well-fitted nature of face coverings consistent with surgical masks, the fixed position of masks on individuals, and the exclusion of partial masking from the model. Additionally, assumptions regarding the non-settlement of aerosols onto the floor and the stationary nature of participants during simulations are explicitly stated.	The study provides the formulas associated with the model, including the quanta-dispersion equation (QDE).	The results and conclusions presented by the authors are consistent with the methodology and assumptions of the study. The findings highlight the effectiveness of combined mitigation strategies in reducing the transmission of SARS-CoV-2 in classroom settings. The conclusions are supported by the detailed CFD simulations and the statistical analysis of transmission routes and probabilities.	**Moderate**
Gao, 2021 (37)	The description of the population and the interventions to be evaluated in the study is somewhat general. The study focuses on a	The description of the model appears to be both complete and appropriate. The authors have defined a theoretical simulation framework to assess the role of different	The authors have published the assumptions of their model, acknowledging its simplifications. For instance, they assume that long-range airborne droplets are evenly	The formulas associated with the model are published, with detailed description of the multi-route transmission model. T	The results and conclusions of the authors appear to be consistent with the objectives and findings of the study. The study distinguishes between different	**Moderate**

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
	theoretical simulation framework to assess the role of different transmission routes for respiratory infections, which implies a broad applicability to various populations without specifying demographic characteristics such as age, health status, or geographic location. This broad approach is understandable given the study's aim to develop a generalizable model that can inform policy and guide interventions across different settings and populations. Regarding the interventions, the study provides a clear description of the interventions evaluated, including increasing exposure distance, increasing ventilation rates, and wearing masks.	transmission routes for respiratory infections. The model highlights critical parameters determining the contributions of different transmission routes and evaluates intervention methods such as increasing exposure distance, ventilation rates, and wearing masks. The simulation codes are made freely available, enhancing the model's transparency and utility for further research.	distributed inside a room, which may deviate from real-world scenarios.		transmission routes and evaluates how key parameters impact the total infection risk and the relative contribution from each route. The findings are consistent with the study's goals to improve the understanding of transmission dynamics and inform intervention strategies.	
Ghoroghi et al., 2022 (38)	The population is defined as individuals and staff within a specific zone of Cardiff University, with a clear explanation of the space's capacity and ventilation strategies. The interventions evaluated include wearing surgical face masks, vaccination coverage, hand hygiene practices, and the implementation of specific	The description of the model appears to be complete and appropriate for the study's objectives. The study employs Agent-Based Modelling (ABM) to simulate the spread of SARS-CoV-2 in indoor environments, considering different ventilation scenarios (Mechanical ventilation with no optimization, Mixed ventilation with no optimization, and Mixed ventilation with optimization).	The study published its major assumptions, particularly regarding the simplification of geometry for furniture and people, the assignment of heat generation per person, and the conditions applied to the CFD simulation.	The study provides specific formulas related to the model, such as the formula used to determine the number of needed iterations for the model to run.	The results and conclusions presented by the authors appear to be consistent with the objectives and methodology of the study. The study aimed to model and analyzed the quality of the indoor environment and the efficacy of safety measures in preventing the spread of the SARS-CoV-2 virus in public buildings. There is consistency between	**Moderate**

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
	hygiene measures within the selected zone.	Computational Fluid Dynamic (CFD) modelling is also discussed to simulate and investigate airflow distribution in various ventilation scenarios.			the study's results and conclusions.	
Guyot et al., 2022 (39)	The description of the population and the interventions to be evaluated appears to be adequately detailed for the purpose of the study. The selection of a real-world multi-family building as the case study provides a practical context for the analysis. The comprehensive evaluation of different ventilation systems and dilution strategies through window and door openings allows for a thorough investigation of potential mitigation measures.	The description of the model used in the study appears to be both complete and appropriate for the objectives of the research. The study employs a multizone approach using CONTAM software to investigate airflows and particle concentrations within a multi-family building, focusing on a "reference apartment". Each room in the house is modeled as one air zone, totaling 11 zones, with the indoor temperature maintained at 20°C, which is a standard assumption for such studies. The study also considers different ventilation systems and door/window opening scenarios to evaluate their impact on airflows and particle concentrations.	The authors have published several key assumptions of their model. These include the assumption of well-mixed air in every zone. The indoor temperature is assumed to be maintained at 20°C, and specific air leakage values for different parts of the building are used based on literature data. However, it's not clear if all assumptions related to the behavior of aerosolized viruses, such as their reactivity on surfaces or agglomeration behavior, are fully detailed. Supplementary material is not freely accessible.	The study provides some specific details about the formulas and methodologies used for modeling, such as the two-way flow model for airflows through open windows and doors, and the use of a discharge coefficient for these openings. For the ventilation systems, the study mentions the use of calculated operating curves and power laws to model airflows through trickle vents.	The results and conclusions appear consistent with the methodology and assumptions described. The study identifies that dilution strategies are more effective in reducing the risk of infection for almost all inhabitants, which aligns with the expected outcomes based on the described ventilation strategies and their implementation in the model.	**Moderate**
Jones et al., 2021 (40)	The population described in the reference scenario is a standard school classroom with 32 occupants, of which one is infected with SARS-CoV-2, over a 7-hour school day. The interventions evaluated include maintaining low metabolic rates of occupants to minimize respiratory rates and thus exposure, and the application of ventilation	The description of the model used in the study is complete and appropriate. The authors have developed an analytical model to predict the number of viral genome copies (RNA copies) inhaled over a period in an indoor space. This model is implemented to investigate a range of scenarios and spaces using Excel spreadsheets and bespoke MATLAB code. A mass-balance model is central	The authors have published the assumptions of the model, which are crucial for its application and interpretation. The model assumes that RNA copies are generated at a single point at a constant rate and are mixed rapidly so that the change in the number of RNA copies in the space, with time, is approximately the same regardless of the sampling point. It also	While the text provides a general description of the model and its assumptions, it does not explicitly detail the formulas used within the model. The rate of change in the number of RNA copies in the space is described by a linear differential equation, but the specific formula is not provided.	The results and conclusions drawn from the model appear to be consistent with the methodology employed. The model is applied to a reference scenario (a standard school classroom) and other indoor scenarios, with a Monte Carlo approach used to quantify uncertainty in predictions. The Relative Exposure Index (REI) is introduced as a measure to compare different indoor	**Moderate**

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
	as a practical intervention to manage and regulate indoor spaces . The description of the population and the interventions to be evaluated is adequate for the scope of the study.	to this approach, which is used to investigate the number of RNA copies contained in aerosols transported to and from an indoor space. The model assumes rapid mixing of RNA copies generated at a constant rate, ensuring uniform distribution throughout the space.	assumes that no RNA copies are transported into the space from outside or connected spaces.		spaces and activities in terms of exposure risk. The findings that ventilation should be monitored in classrooms to minimize far-field aerosol exposure risk and that scenarios involving high aerobic activities or singing have higher REI values are logical conclusions.	
Liu et al., 2023 (41)	The description of the population in this study is somewhat limited, focusing solely on the simulated manikins within a three-row segment of an aircraft cabin. While this simplification is understandable given computational constraints, it may not fully capture the complexity of human behavior and movement within a larger, fully occupied cabin. The interventions evaluated, namely the DV and MV ventilation systems, are adequately described in terms of their operational principles and the specific configurations used in the simulations.	The description of the model used in the study is both complete and appropriate. The authors have detailed the geometry and meshing of the aircraft cabin segment, including the simplifications made due to computational constraints, such as modeling only three rows of seats and using manikins to represent passengers. The boundary conditions, including the mouth opening for droplet release and the environmental conditions like relative humidity and temperature, are also clearly defined. The use of a well-validated Computational Fluid Particle Dynamics (CFPD) model, along with the SST k-ω model for airflow and droplet propagation, and the integration of the Wells-Riley model for assessing respiratory disease transmission risk, indicates a comprehensive approach to modeling the cabin environment under different ventilation systems.	The authors have published the assumptions underlying their model. These include the simplification of the cabin geometry, the representation of passengers by manikins, and the assumption about the main heat source in the cabin. Assumptions regarding the evaporation process of droplets, based on relative humidity and temperature, and the content of volatile and non-volatile substances in the droplet solution are also explicitly stated. Furthermore, the assumption of symmetrical dispersion of the airflow field allowing for the simulation of only one half of the chamber is mentioned, which is crucial for understanding the model's limitations and scope.	The study provides a detailed publication of the formulas associated with the model. This includes the governing equations for the continuous air and evaporation process of liquid droplets, the dynamic diffusion rate of water vapor, and the phase change latent heat transfer formula. Additionally, the study details the equations used in the Wells-Riley model for assessing the risk of respiratory disease transmission and the PSI-C scheme for integrating the mass of fine particles over time to obtain the concentration of the discrete phase in a cell. These formulas are essential for understanding the computational framework and the basis for the simulation results.	The results and conclusions presented by the authors are consistent with the methodology and analysis employed in the study.	**Moderate**

LES 15.2: Effectiveness of VADF for reducing transmission of RIDs in non-health care community-based settings.

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
Luo et al., 2023 (42)	The description of the population and the interventions evaluated in the study appears to be focused on a specific scenario: the dispersion of infectious droplets in a coach bus environment during a COVID-19 outbreak. However, the paper does not explicitly detail the characteristics of the population involved, such as the number of passengers, their seating arrangement, or health status. Instead, the study seems to concentrate on the environmental and mechanical interventions to mitigate infection risk, including opening and closing windows and the use of a wind catcher, bus speeds, infector location and Ambient Temperature.	The description of the model used in the study is comprehensive and appropriate for the objectives outlined. The model incorporates a coupled approach to simulate both outdoor wind flow and indoor airflow within a coach bus, considering various factors such as window positions, areas for natural ventilation, and the addition of a wind catcher. The physical model is based on a double-decker 48-seat coach bus, with detailed dimensions provided and specific infector positions identified to assess the impact on potential infection risk. The computational domain, grid arrangements, and boundary conditions are clearly described, ensuring a thorough understanding of the modeling environment.	The study published several assumptions critical to the model's construction and simulation processes. These include the use of the RNG k-ε model for simulating airflows, the application of the Boussinesq hypothesis for thermal buoyancy effects, and the selection of ethane (C2H6) as a tracer gas to represent fine droplet nuclei. Additionally, assumptions regarding the ambient relative humidity and the initial diameters of exhaled droplets are explicitly stated. These assumptions are essential for the simulation's realism and computational feasibility, providing a clear basis for the model's operation.	The study provides specific formulas related to the model, such as those for calculating the gradient of vapor concentrations between the droplet surface and the surrounding air, and for assessing the Sherwood number, which is crucial for understanding mass transfer processes. These formulas are integral to the simulation of droplet dispersion and the evaluation of potential infection risk, demonstrating the study's scientific rigor and the detailed nature of the modeling approach.	The results and conclusions presented by the authors appear to be consistent with the methodologies and analyses conducted throughout the study. Overall, the consistency between the study's results and conclusions is evident, as the authors effectively demonstrate how the interventions studied can contribute to reducing the potential infection risk in a coach bus environment. The study's methodology, analysis, and findings all align to support the conclusion that improving natural ventilation through the opening of windows and the use of a wind catcher, along with considering other factors such as bus speed and infector location, can be effective strategies in mitigating the spread of airborne diseases in public transportation.	**Moderate**
Martinez, 2022 (43)	The description of the population in the study is somewhat implicit, focusing primarily on occupants of a "realistic office scenario." While specific demographic details of the population are not provided, the study's context suggests a diverse group of office workers. The agent-based model's ability to simulate individual behaviors and	The description of the model used, ArchABM, is comprehensive and appropriate for the study's objectives. It integrates the model developed by Peng et al., which calculates both the virus quanta concentration and the CO2 mixing ratio in a specific place. This model is chosen for its ability to provide an overall picture of indoor air quality (IAQ), crucial for assessing the	The assumptions underlying the model are implicitly published through the description of its operation and the adaptation of equations to simulate real-world scenarios. For instance, the adaptation of the standard model to account for the dynamic nature of human interactions within indoor environments and the decay of virus quanta	The formulas associated with the model, particularly those adapted from the standard model by Peng and Jimenez, are published and discussed. This includes equations for calculating the quanta concentration during events and its decay due to ventilation rates, virus decay rate, and deposition rate to surfaces. These formulas are crucial for understanding how the model simulates the dynamics of virus transmission and IAQ under different scenarios.	The results and conclusions presented by the authors appear to be consistent with the methodology and objectives of their study. The study found that limiting meeting duration and wearing masks were among the most effective measures in improving IAQ and reducing virus transmission risk. This conclusion is supported by the statistical analysis of the experiments, which showed	**Moderate**

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
	interactions suggests that the population dynamics, although not explicitly detailed, are adequately represented for the study's purposes. The interventions evaluated in the study are well-described and relevant to the objective of improving indoor air quality in office environments.	airborne transmission of SARS-CoV-2.	concentration in the absence of contagious individuals are significant assumptions. While explicit listing of all assumptions is not provided, the critical assumptions for the model's operation and adaptation are discussed.		significant reductions in CO2 and virus quanta levels when these interventions were applied.	
Miller et al., 2022 (44)	The description of the population and interventions in the study appears to be adequately detailed for the purpose of modeling virus transmission in a subway train context. The population is implicitly defined as subway passengers, with distinctions made based on their infectious status (infectious vs. non-infectious) and behaviors (mask-wearing, hand hygiene practices). The interventions evaluated include practical measures that can be implemented in public transportation settings. However, the study could benefit from a more explicit description of the demographic characteristics of the population (age, health status, etc.) and how these might influence exposure	The Transmission of Virus in Carriages (TVC) model is described as a computational model simulating potential exposure to SARS-CoV-2 for passengers traveling in a subway rail system. It considers exposure through three different routes: fomites via contact with contaminated surfaces; close-range exposure, accounting for aerosol and droplet transmission within 2 meters of the infectious source; and airborne exposure via small aerosols not reliant on being within 2 meters distance from the infectious source. The model incorporates typical subway parameters and aims to evaluate the relative effect of environmental and behavioral factors, including virus prevalence in the population and the number of people.	The authors have outlined the main assumptions behind the TVC model, including the modeling of the three different transmission routes (fomite, close-range, and long-range airborne) and the simulation of individual passengers' journeys. They acknowledge the limitations and assumptions that may influence model outcomes, such as fixed parameter values and assumptions based on existing knowledge. Specific behavior-related parameters, like the number of surfaces touched by passengers or the time for passengers to sanitize their hands, are highlighted as areas where assumptions were made due to the lack of detailed data. While the authors have published several assumptions, the detailed list of assumptions, especially those related to parameter	Details on how representative transportation is chosen when simulating passenger trips and estimating SARS-CoV-2 exposure within the TVC model are provided in the supplementary material. They also show how passengers are located within a 2 m radius of an infected passenger during their trip, and we provide an overview of the method used to adjust the surface area within 0-1 m and 1-2 m of the infected passenger to consider possible positions of this passenger inside the car. The surface area within the carriage as a whole and the region of the carriage within 2 m of an infectious passenger are estimated. Finally, precise details on the implementation of the different droplet models and droplet evaporation calculations are provided, and a complete list of parameter values within the TVC model is provided.	The authors' results and conclusions are consistent with the data and analyses presented, demonstrating a comprehensive and methodical approach to evaluating the risk of SARS-CoV-2 transmission in subway environments. The findings are well-supported by the model's predictions and the sensitivity analysis conducted, providing a reliable basis for the conclusions drawn.	**Moderate**

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
	risks and the effectiveness of interventions.		values, is found in the Supplementary Material.			
Mizukoshi et al., 2023 (45)	The description of the population and the interventions to be evaluated appears to be adequate. The study provides a clear overview of the office environment, the number of employees involved, and the spatial distribution of infected cases, which is crucial for understanding the transmission dynamics within the office. The methodology for evaluating the efficacy of infection control measures, including the modeling of transmission pathways and the simulation of exposure scenarios, is well-defined and appropriate for the study's objectives.	The description of the model used in the study appears to be complete and appropriate for the objectives set forth. The study employs a well-mixed model to describe virus concentration in the air across different zones within an office environment, which is a typical approach for assessing the risk and efficacy of infection control measures in such settings. Additionally, the fomite transmission pathway is modeled using a Markov chain, which is a recognized method for analyzing transitions between states in epidemiological studies.	The study published the assumptions of the model. These assumptions include: 1.The mask removal efficiency for aerosols. 2. The office spaces. 3. The fomite transmission pathway. 4. Several specific assumptions were made regarding the environmental conditions and the behavior of the virus. Such as the uniform emission of droplets and aerosols by multiple cases with the same high virus concentration in the saliva, which may be overestimated. The decrease of source case numbers by infection control measures and the transmission in spaces other than the office room, such as elevators or restrooms, were not considered.	The study published the formulas associated with the model, specifically the equations describing the virus concentration in the air for each zone within the office environment. These equations are fundamental to understanding how the model quantifies the risk of transmission and evaluates the efficacy of infection control measures. The publication of these formulas allows for a clearer understanding of the model's workings and its application to the study's objectives.	The results and conclusions presented by the authors seem to be consistent with the methodology employed and the data collected. The study aimed to deduce the transmission cause and estimate the effectiveness of prevention control measures for each transmission pathway by simulating exposure to SARS-CoV-2 in a similar indoor space under the same environmental conditions as the cluster. The study's objectives, to verify the quantitative risk from each transmission pathway and quantify the control measure effects such as masks and ventilation, align with the models and methodologies described, suggesting a consistency in the results and conclusions.	**High**
Mokhtari,2021 (46)	The description of the population and the interventions evaluated in the study is adequate, offering a clear and detailed overview of the research context, the measures taken to address the research questions, and the methodologies employed to evaluate the interventions' effectiveness.	The description of the model used in the study appears to be complete and appropriate for the objectives set by the authors. The model integrates aspects of building energy consumption and COVID-19 infection risk, employing the NSGA-II algorithm for multi-objective optimization. The study uses EnergyPlus for energy simulation and incorporates the Wells-Riley and Gammaitoni-Nucci models for assessing COVID-	The authors have published several key assumptions of their model. These include the consideration of only respiratory transmission risk for COVID-19, the constant quanta emission rate, and the assumption that the period of the disease is longer than the time scale of the model. While these assumptions are critical for simplifying the complex reality of COVID-19 transmission and building	The study has published essential formulas associated with the model, including those for calculating the PMV value for thermal comfort, the sensible heat generated by occupants, and the equations used in the optimization problem to minimize the number of infected people and energy consumption. Additionally, the study references the Wells-Riley and Gammaitoni-Nucci models for infection risk assessment, providing a basis for the infection risk calculation. However, the detailed mathematical representation of the COVID-19	The results and conclusions presented by the authors seem consistent with the objectives and methodology of the study. They successfully demonstrate the application of their model in a case study building, showing how the optimization approach can lead to a set of non-dominated solutions that balance the trade-off between minimizing infection risk and energy consumption. The use	**High**

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
		19 infection risk, which are well-regarded in their respective fields. The integration of these models to simultaneously minimize infected people count and HVAC system energy consumption is both innovative and relevant to the current global context.	energy dynamics, it is not clear if all assumptions have been fully disclosed, such as assumptions related to occupant behavior or specific HVAC system operations.	infection risk model, particularly how it integrates with the building energy model, could be further elaborated for complete clarity.	of validation data from several universities in the United States to validate the mathematical model for estimating the number of infected people adds credibility to their conclusions.	
Moritz,2021 (47)	The description of the interventions is thorough and provides a clear understanding of the measures implemented to mitigate the risk of COVID-19 transmission during the event. The detailed account of hygiene practices, contact tracing efforts, and the use of simulation models to predict aerosol distribution and epidemiological outcomes offers a comprehensive overview of the study's methodology. The description of the population involved in the study (age, sex and place of origin) is detailed in the supplementary material.	The description of the model used in the study appears to be comprehensive and appropriate for the objectives of the research. The methodology includes an experiment with a pop concert under controlled conditions, assessment of aerosol distribution using computational fluid dynamics (CFD), and an epidemiological simulation integrating contact tracing and aerosol distribution results. Additionally, the study incorporates a contact network model based on the European POLYMOD contact study, with specific adaptations to the population of Leipzig, considering various contact settings and network sizes.	The study published several key assumptions of the model. It assumes specific daily contact rates based on the POLYMOD study, adjusted to the demographics of Leipzig. It outlines the types of contact settings considered (household, school/work, and other) and details regarding the selection of individuals for different settings, such as schools, workplaces, and events. The model also assumes that only contacts longer than 15 minutes are considered high-risk, in line with the RKI definition. In the supplementary material the authors describe the model parameters and other assumed assumptions.	The study provides a summary of the detailed parameters and equations used for the aerosol distribution model, including how aerosol exposure was quantified and the use of particle tracking software for aerosol movement simulation. Additionally, the parameters and equations with their details are specified in annex 41467_2021_25317_MOESM1_ESM.In the case of epidemiological simulation, the model used is the SEIR, in the R program, for which the authors provide the code in a Zénodo database, and the results obtained are all in 3 annexes that consist of Excel tables with output data.	The results and conclusions drawn by the authors seem consistent with the methodology and data presented. The study employs a rigorous approach to model SARS-CoV-2 transmission risk during a mass gathering event, integrating experimental data, aerosol dynamics, and epidemiological simulations. The use of a detailed contact network model tailored to the specific demographics of Leipzig adds to the credibility of the findings.	**High**
Niu et al., 2022 (48)	The study mentions occupants of an office building as the population for the subjective survey. However, it does not provide specific details	The studies referenced provide a comprehensive description of the models used to evaluate the indoor environment and personnel satisfaction. For instance, Cao	While the studies mention the development and application of models, there is a lack of explicit detail regarding the assumptions underlying these models in	The studies provide some formulas related to the models and analyses used. For example, the formula for calculating the gray correlation degree between the comparison sequence and the reference sequence is explicitly mentioned, which	The results and conclusions presented in the studies appear to be consistent with the methodologies and analyses employed. For instance, the findings that	**Moderate**

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
	about the demographic characteristics of the participants (e.g., age, gender, occupation) or the total number of participants involved. Such information is crucial to understand the representativeness and generalizability of the findings. The study evaluates the impact of fresh air systems on the indoor environment, focusing on air quality and temperature. While it mentions assessing different operation modes of these systems for epidemic prevention, it does not detail the specific interventions or changes made to the fresh air systems.	et al. (2012) developed a multivariate regression model for overall satisfaction in public buildings based on field studies, which suggests a detailed approach to modeling. Similarly, the study by Pei et al. (2015) established a regression model of indoor environmental parameters and personnel satisfaction, indicating a methodological framework for predicting and assessing the indoor environment.	the provided citations. For a thorough evaluation, it is crucial to understand the assumptions made during model development, such as linearity, independence of errors, or normal distribution of residuals, which are not explicitly detailed in the provided references.	is crucial for understanding the analysis of the impact of indoor environmental parameters on personnel satisfaction. However, not all formulas or mathematical expressions directly associated with the regression models or other evaluative models are detailed in the provided citations, which might limit the ability to fully replicate or scrutinize the study's methodology.	temperature, fresh air volume, and CO2 concentration significantly influence personnel satisfaction align with the models' focus on evaluating indoor environmental parameters. Furthermore, the emphasis on both objective and subjective analyses supports a comprehensive understanding of the indoor environment's impact on personnel satisfaction, reinforcing the consistency of the study's conclusions with its results. The studies' conclusions about the importance of considering various environmental parameters in the design of air conditioning and fresh air systems to enhance personnel satisfaction also logically follow from the analyses conducted.	
O' Donovan et al., 2023 (49)	The population in focus is implicitly defined as occupants of university lecture rooms, which likely includes students and faculty members. The interventions evaluated, namely different ventilation retrofit scenarios, are well-described and relevant to the study's objectives.	The description of the model used in the study is complete and appropriate for the objectives set out by the authors. The methodology involves a three-stage infectious risk assessment modeling methodology, which includes ventilation airflow rate modeling, a design stage airborne infectious risk modeling check, and a seasonality check stage. The use of the Wells-Riley model is central to this methodology.	The authors have published the assumptions of the model, which include the use of static models for practical usability at the early building design stages, the assumption of well-mixed indoor air with contaminants homogeneously distributed, and the consideration of sedentary nature of lecture room environments. Additionally, the study acknowledges the uncertainty in predicted airflow rates and its impact	The study published the formulas associated with the model, including the equation defining the infiltration airflow rate based on the work of Sherman and Grimsrud and the classical form of the Wells-Riley equation for assessing the risk of infectious disease transmission.	The results and conclusions of the authors are consistent with the methodology and findings presented in the study. The conclusions are supported by the study's findings on the effectiveness of different ventilation retrofit scenarios and the impact of various factors on airborne infectious risk, demonstrating a logical consistency between the results and the authors' conclusions.	**Moderate**

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
			on the Wells-Riley model's output, providing a degree of transparency about the model's limitations			
Osterman, 2022 (50)	The description of the population and the interventions to be evaluated appears to be adequately detailed for the purpose of the study. The population in question includes occupants of the selected educational building, with specific attention to parameters that affect the spread of infectious aerosols, such as the maximum number of occupants and the number of seats. The interventions evaluated include the existing ventilation systems and the potential for natural ventilation through the opening of windows.	The description of the model used in the study is complete and appropriate. The study employs the Wells-Riley model to determine the probability of infection for the selected space and human activity. This model is well-regarded for assessing the risk of airborne transmission of infectious diseases in indoor environments. The use of the REHVA COVID-19 ventilation calculator, based on the Wells-Riley model, is specifically mentioned.	The authors have published all the critical assumptions of the model. These include the constant rate of quanta emission throughout the event, the presence of an infected occupant in the room during all occupancy time, the even distribution of infectious respiratory aerosol throughout the well-mixed room air, and the removal of infectious quanta by ventilation, filtration, deposition, and airborne virus decay. These assumptions are fundamental to the Wells-Riley model and their disclosure ensures transparency and reproducibility of the study's findings.	The study has published the formulas associated with the model. The probability of infection is defined by a specific equation, and the average concentration of infectious quanta is defined by another equation. The publication of these formulas allows for an understanding of how the probability of infection is calculated and the factors that influence it.	The results and conclusions of the authors appear to be consistent with the methodology and findings of the study. The study assesses the ventilation efficiency in an educational building and uses the REHVA calculator to estimate the risk of infection under different scenarios. The conclusions drawn from these results are in line with the objectives and methodology of the study, demonstrating a logical consistency throughout	**High**
Pang, 2023 (51)	The description of the population and interventions in the study appears to be adequately detailed for the purpose of the research. The population in focus is occupants of office buildings, which is a relevant group for studying the spread of COVID-19 in indoor environments. The study specifically considers variables that affect this population, such as occupancy density and	The description of the model used in the study is both complete and appropriate. The model is based on the EnergyPlus medium-sized office building model, which is detailed with a three-story structure and a total floor area of 4,982 m^2. It includes various space types such as enclosed offices, open offices, and conference rooms, which are relevant for assessing COVID-19 infection risk in an office environment. The model settings also detail the	The study published its assumptions regarding the model, particularly in the context of occupant behavior and the pre-COVID-19 occupancy schedules. It acknowledges that the occupant schedule used was based on pre-COVID-19 behaviors, which is an important assumption given the impact of occupancy on infection risk and building energy consumption.	The study published the formulas associated with the model, particularly the Gammaitoni-Nucci (GN) model used for quantifying COVID-19 infection risk. The GN model equation is provided, along with the necessary input parameters for the model, such as pulmonary ventilation rate, space volume, air change rate, quanta generation rate, number of infectors, and exposure time interval.	The results and conclusions of the study are consistent in several aspects of the risk of COVID-19 transmission in indoor environments and the role of ventilation in mitigating these risks. Furthermore, the study recognizes limitations such as not considering the loss and deposition of aerosol particles or the filtration effect of air filters and/or face masks, which could lead to an overestimation of the risk of infection. Overall, the	**Moderate**

LES 15.2: Effectiveness of VADF for reducing transmission of RIDs in non-health care community-based settings.

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
	exposure time, which are critical factors in assessing infection risk. The interventions evaluated are clearly defined and relevant to the study's objectives. The supplementary material provides a more detailed description of the characteristics of the office buildings, the climatic conditions of the cities and other important aspects for the development of the model such as office occupancy.	HVAC system, including air handling units (AHU) for each floor and variable air volume (VAV) terminal boxes for each zone, which are crucial for understanding the air quality and ventilation effectiveness in the building.	In the supplementary material the authors describe the model parameters and other assumed assumptions.		study's conclusions are consistent with its findings, emphasizing the importance of ventilation in managing the risk of COVID-19 transmission while also highlighting the need for future research to address its limitations.	
Pease et al., 2021 (52)	The description of the population and the interventions to be evaluated is somewhat implicit rather than explicitly detailed. The population, in this case, seems to be occupants of a small multiple room building, potentially including residential, office, or healthcare settings, given the focus on SARS-CoV-2 transmission. The study does not delve into specific population demographics or behaviors that could influence individual risk levels. However, given the study's primary aim to evaluate environmental interventions rather than individual-level outcomes, this approach can be deemed appropriate. The	The description of the model used in the study is both complete and appropriate. The authors explicitly derive equations and describe parameters to evaluate the influence of filtration, air change rates, and the fraction of outdoor air on the probability of infection using a well-mixed modeling approach for a multiroom building.	The authors have published the assumptions of the model, which are critical for understanding the scope and applicability of their findings. For instance, the well-mixed approximation assumes uniform concentration within each room and the common plenum, which simplifies the complex dynamics of aerosolized particles in indoor environments.	The publication includes the formulas associated with the model, which are essential for replicating the study's findings or applying the model to other settings. Equations are provided for the conservation of mass in the context of a connected multiroom building, accounting for various factors such as air change rates, decay rate constants, and settling velocity of particles.	The results and conclusions presented by the authors are consistent with the methodology and analysis employed in the study. They conclude that filtration is the most effective method in lowering aerosol concentration and probability of infection, followed by the introduction of outdoor air. These conclusions are directly supported by the quantitative analysis of aerosolized viral spread in a multiroom building and align with the theoretical framework established by the well-mixed model approach. The use of the Wells-Riley equation to connect the model's outcomes with the risk of infection further solidifies the consistency between the results and the conclusions.	**High**

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
	interventions evaluated are well-described and relevant to the study's goals, providing valuable insights into how building ventilation systems can be optimized to reduce the risk of aerosolized viral transmission.					
Ren, 2022 (53)	The study's description of the interventions, specifically the comparison between different ventilation modes (MV, SFRC-1, and SFRC-2) and the optimization of supply air parameters, is adequately detailed. It provides a clear understanding of the variables being tested and the rationale behind choosing these specific interventions to improve the subway carriage environment. However, the description of the population is not explicitly mentioned. While the study includes questionnaires to gauge passenger satisfaction, there is no detailed information on the demographic characteristics of the population sample, such as age, gender, or health.	The description of the model used in the study is comprehensive and appropriate for the objectives set forth. The study employs Computational Fluid Dynamics (CFD) simulations to analyze the effects of different ventilation modes on airflow, temperature, and CO2 concentration within a subway carriage. The use of the Re-Normalization Group (RNG) k-ε model for solving the Reynolds averaged Navier-Stokes (RANS) equations is specified, which is suitable for capturing the turbulence characteristics of airflow in such environments. Additionally, the study incorporates various evaluation models (ADPI, PMV, PRE, infection probability, and cooling load) to assess the comprehensive performance of the ventilation systems.	While the study outlines the general framework and methodology, there is a lack of explicit detail regarding all the assumptions made within the model. For instance, the study mentions the use of heat source terms for passenger sensible heat and equipment, and CO2 sources for passengers, which are defined using User-Defined Function (UDF). However, the specific assumptions related to these source terms or how they were quantified are not fully disclosed.	The study provides some of the formulas associated with the model, such as the general forms of momentum, temperature, and pollutant transport equations. Additionally, the formula for calculating the Predicted Mean Vote (PMV) is also shared, which is used to represent the level of thermal comfort of occupants. However, the detailed formulas for other evaluation models like ADPI, PRE, and infection probability are not explicitly provided in the summary.	The results and conclusions presented by the authors appear to be consistent with the methodology and objectives outlined in their study. The authors aimed to investigate the effects of different ventilation systems on environmental parameters, infection risk, and energy consumption in subway carriages. The relative quantitative results of the comprehensive benefit evaluation for different ventilation systems further support their conclusions. Therefore, based on the detailed methodology, analysis, and evaluation presented, the authors' conclusions are consistent with their results	**Moderate**
Ren,2022 (54)	The description of the population (i.e., classroom occupants) and the interventions (i.e., window design optimizations and	The description of the model used in the study is both complete and appropriate. The study provides detailed dimensions of the classroom,	The study clearly outlines its assumptions. For instance, it mentions that the driving force of temperature is not considered due to the	While the study provides a detailed description of the computational setup and boundary conditions used in the simulations, including the inflow profile of wind speed and the conditions for	Results and Conclusions the results and conclusions of the authors are consistent. The findings indicate that these interventions can enhance	**Moderate**

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
	the use of window-integrated fans) is adequately detailed. The study specifies the classroom's dimensions, the arrangement and number of desks, and the maximum occupancy to ensure a minimum safe distance of 1 meter between individuals. This level of detail provides a clear understanding of the study's context and the spatial constraints within which the interventions are evaluated. The interventions themselves, including the optimization of window openings and the implementation of window-integrated fans, are described in terms of their objectives to enhance ventilation efficiency and reduce infection risk. The study's methodology, combining experimental validation with detailed numerical simulations, allows for a comprehensive evaluation of these interventions.	including its length, width, height, and volume, as well as specifics about the ventilation sources such as doors and windows. It also describes the classroom setup, including the arrangement of desks and the maximum number of occupants, ensuring a safe social distance.	potentially negligible temperature difference between indoor and outdoor environments during transition seasons, which are more favorable for natural ventilation. This assumption is critical as it simplifies the model by focusing on wind-driven natural ventilation without the complexities introduced by thermal effects. However, the study might not detail all assumptions related to the model's physical properties or the simplifications made in the simulation setup, such as assumptions about occupant behavior or the emission rates of contaminants.	various boundaries (doors, windows, walls), it does not explicitly publish the mathematical formulas associated with the model's core dynamics, such as the equations governing airflow or contaminant dispersion within the classroom. The reference to the use of commercial ANSYS Fluent 16.0 software for simulations is made, but specific formulas or equations directly used in the simulations are not detailed in the provided excerpts.	ventilation efficiency and reduce infection risk, particularly in transitional seasons with mild outdoor temperatures. This conclusion is supported by numerical simulations that show acceptable performance for cross-ventilation, with prediction errors for indoor average velocity and Air Changes per Hour (ACH) values within acceptable margins. Furthermore, the study acknowledges its limitations and suggests areas for future research, such as the need for more detailed simulation setups and the exploration of low-cost prevention approaches in poorly designed and ventilated rooms.	
Riediker et al., 2020 (55)	The description of the population and the interventions, as provided, appears to be somewhat adequate but lacks specific details that would be crucial for replicating the study or assessing its applicability to broader contexts. The population is	The description of the model used in the study appears to be complete and appropriate for the objectives set by the researchers. The researchers used a well-mixed 1-compartment model to simulate the situation in a closed room with different ventilation air exchange rates.	The study published its assumptions regarding the viral load present in the lining liquid of respiratory bronchioles, based on data from sputum and swab samples of individuals with COVID-19. The assumptions for viral load estimations were 1000	While the study provides a detailed description of the methodology and the assumptions behind the viral load estimations, it does not explicitly publish the formulas associated with the model in the provided excerpts. The detailed statistical analysis and the models' code are mentioned to be available on request, which suggests that while the formulas might be available	The results and conclusions of the authors are consistent. The mathematical modeling conducted by the authors suggests that the viral load in the air can reach critical concentrations in small and poorly ventilated rooms, especially when the individual is a super-spreader. This	**Moderate**

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
	described in broad terms as individuals with asymptomatic to moderate COVID-19, without specifying the criteria used to define these categories or any demographic information about the participants (age, sex, underlying health conditions). The interventions evaluated, namely the impact of breathing and coughing by infected individuals in small, poorly ventilated rooms, are described at a high level.	This approach is suitable for assessing the risk of aerosol transmission in a controlled environment, such as a medical examination room or an office shared by 2 to 3 people. The methodology follows the concept of Strengthening the Reporting of Empirical Simulation Studies (STRESS) guideline.	copies/mL for a low emitter, 10^6 copies/mL for a typical emitter, and 1.3 × 10^11 copies/mL for a high emitter.	for further scrutiny, they are not directly published within the study's text.	finding is in line with their conclusion that strict respiratory protection is recommended in such environments to mitigate the risk of infection, particularly when in the presence of individuals emitting a high viral load through coughing for prolonged periods.	
Sarhan et al., 2022 (56)	The description of the population and the interventions evaluated appears to be adequately detailed for the study's objectives. The computational domain was assumed to be a medium-sized passenger car with a driver and three passengers, labeled as Driver, Passenger A, Passenger B, and Passenger C. The infected person's location is referred to as the index case. The study's focus on identifying the safest spot within the passenger car while sharing it with a COVID-19 patient is clear, and the interventions evaluated—different modes of the HVAC system—were relevant to	The description of the model used in the study is comprehensive and appears to be appropriate for the objectives of the investigation. The authors employed a 3D numerical model of airflow and associated aerosol transport within a passenger car using commercial CFD software AVL FIRE 2021. The Eulerian method coupled with the k-ε model was utilized to simulate the airflow field in the computational domain, which is a medium-sized passenger car with a driver and three passengers. The study also considered human respiration activities, such as breathing and speaking, within the car cabin. This level of detail in the model description, including the use of turbulence models	The authors have published key assumptions of the model. These include the assumption that aerosol transport is a 2-phase flow where gas is the continuous phase, and the droplets/particles are a dispersed phase. The study assumes a specific size for the droplets (≥ 1 µm) and considers gravity's role in particle sedimentation. The breathing and speaking activities of both infected and non-infected individuals are modeled with specific rates and a sinusoidal cycle for inhalation and exhalation. These assumptions are critical for understanding the model's framework and the conditions under which the simulations were performed.	The study provides detailed formulas associated with the model, including those for calculating the relative velocity between phases, the drag coefficient, and the terminal velocity of droplets. These formulas are essential for understanding how the model predicts the behavior of aerosols within the car cabin. The inclusion of such mathematical details contributes to the transparency and reproducibility of the study's findings.	The results and conclusions presented by the authors are consistent with the objectives and methodology of the study. The findings indicate the time duration to get infected and are effective in the prevention of infectious airborne diseases such as SARS-CoV-2 by identifying the movement of droplets. These results align with existing literature on the airborne transmission of COVID-19 and suggest that the model could be useful for future engineering studies aimed at designing public transport and passenger cars.	**High**

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
	the study's aim of reducing the risk of contracting the virus.	and the pressure-based solver with the SIMPLE algorithm, supports the appropriateness of the methodology for predicting aerosol transport and assessing infection risk in a passenger car environment.				
Sha et al., 2024 (57)	The study focuses on the occupants of buildings, specifically high-rise buildings, as the population at risk of COVID-19 airborne transmission. The interventions evaluated include the implementation of a new ventilation control strategy that combines dilution ventilation (DV) and ventilative cooling (VC), along with the optimization of fan flow rates and consideration of real-time occupancy to achieve energy savings without compromising indoor air quality.However, the study could enhance its description by providing more specific details about the demographic characteristics of the building occupants (e.g., age, health status) and the types of buildings (e.g., residential, commercial) considered in the case studies.	The description of the model used in the study appears to be complete and appropriate for the objectives set by the authors. The study introduces a modified Wells-Riley model to calculate the ventilation rates required to reduce the risk of COVID-19 transmission, incorporating factors such as social distancing, mask-wearing, and initial infection rates. Additionally, the study details the energy models used to estimate the cooling and ventilation energy consumption.	The authors have published the assumptions of the model, particularly in the modification of the WR model where they incorporate three coefficients to account for social distancing, wearing a mask, and initial infection rates. These assumptions are based on previous studies that validated the effects of these coefficients, indicating that the authors have considered existing literature to inform their model's assumptions.	The study published the formulas associated with both the energy models and the modified WR model. For the energy models, equations simulating the power of the chiller and components of the mechanical ventilation system are provided. For the modified WR model, the formula used to estimate the infection risk, incorporating the aforementioned coefficients, is explicitly stated.	The results and conclusions presented by the authors are consistent with the objectives and methodology of the study. The authors conclude that operating a ventilation system to provide maximum outdoor airflow rates may be insufficient in preventing the transmission of COVID-19, suggesting the need to consider diluting airborne pathogens in ventilation system design. This conclusion directly follows from the application of the modified WR model and the energy models to a case study building, demonstrating the effectiveness of the proposed ventilation control strategy in reducing infection risk and energy consumption. The validation of the energy models' prediction accuracy further supports the reliability of the study's conclusions.	**Moderate**
Shen et al., 2021 (58)	The description of the population and the interventions evaluated in	The description of the model used in the study is both complete and appropriate.	The study has published all the critical assumptions of the model. It assumes a	The study has published the formulas associated with the Wells-Riley model, detailing how the infection possibility is	The results and conclusions of the authors appear to be consistent with the	**High**

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
	the study appears to be adequately detailed for the purpose of assessing IAQ control strategies against SARS-CoV-2 transmission. The study provides a comprehensive analysis of various IAQ control strategies, including ventilation improvements, filter upgrades, air cleaners, and the use of masks. It also considers the cost and effort of implementation.	The study employs the Wells-Riley model to estimate the infection risk of airborne transmission in enclosed environments, assuming a steady-state and well-mixed indoor environment. Additionally, the study incorporates a modified SARS-CoV-2 airborne transmission model to systematically evaluate multi-scale Indoor Air Quality (IAQ) control strategies, with probability functions of essential model parameters determined based on a comprehensive literature review. The use of a stochastic Monte Carlo approach to account for the variability of input data further enhances the model's robustness.	steady-state and well-mixed indoor environment as per the Wells-Riley model's requirements. The well-mixing assumption, which does not consider the detailed local airflow pattern in the room, is acknowledged as a limitation, indicating transparency about the model's assumptions. The study also assumes the presence of asymptomatic infectors and uses an estimated proportion of active asymptomatic patients to assign the number of index patients in the target space.	calculated as a function of various factors such as the number of pathogen carriers, the infectious quantum generation rate per infector, the fraction of infectious particle penetration through the face mask, pulmonary ventilation rate, exposure time, and the equivalent fresh air change rate in the room. Additionally, specific parameters like the pulmonary ventilation rate and the removal efficiency of filters for infectious particles are discussed with references to equations and tables.	methodology and findings presented. The study observes that under the established baseline conditions, spaces in long-term care facilities, colleges, meat plants, hotels, restaurants, casinos, and cruise ships would face considerable infection probabilities and have a higher potential to spread among people. These conclusions are supported by the systematic evaluation of IAQ control strategies using the described models and assumptions.	
Shinohara et al., 2024 (59)	The study implicitly focuses on passengers of commuter trains in Tokyo, a densely populated urban environment where public transportation is heavily utilized. However, the description of the population is not explicitly detailed in terms of demographics, health status, or behavior patterns (e.g., mask-wearing habits, duration of travel). The interventions evaluated in the study are well-described and relevant to the context of public transportation during a pandemic. The study	The study employs a two-zone model to estimate the concentration of the virus to which a passenger in a commuter train is exposed, distinguishing between near-field and far-field exposures. This model is appropriate for the study's aim to assess airborne transmission risk in a commuter train environment, considering the spatial distribution of passengers and the airflow dynamics within the train cars. The use of a two-zone model is consistent with methodologies in environmental health research that require differentiation between closer proximity	The study clearly outlines several assumptions made within the model. These include the assumption that passengers in both the near-field and far-field are exposed to virus contained in droplet nuclei originating from an infected person, and that near-fields do not overlap with each other to simplify the calculation. Additionally, it assumes the air completely mixed in the near-field exchanges with the air completely mixed in the far-field.	The study provides the formula used in the two-zone model to express the concentration dynamics in the near-field, incorporating elements such as emission and flow volume rates. However, while the study mentions the use of the two-zone model and provides a general description of its application, the detailed mathematical representation of the model, including all variables and parameters for both near-field and far-field calculations, is not fully detailed.	The study concludes that no previous research has evaluated the risk reduction for COVID-19 associated with improved ventilation and window-opening in vehicles, and it aims to fill this gap by determining air exchange rates under several conditions in commuter train cars. The methodology, involving the measurement of air exchange rates and the estimation of airborne infection risk under varying conditions, directly supports the study's objectives. The results and conclusions presented by the authors appear to be consistent with	Moderate

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
	examines the effects of opening windows and using air conditioning or fans on the air exchange rates and, consequently, on the risk of airborne transmission of COVID-19. These interventions are practical and can be easily implemented in the real-world setting of commuter trains.	(near-field) and farther proximity (far-field) to a source of airborne particles or pathogens. objectives are adequately provided.			the methodologies and assumptions described	
Schibuola & Tambani, 2021 (60)	While the study mentions high-density indoor environments and public transportation buildings as the primary focus, it does not provide specific details about the characteristics of these environments (e.g., size, typical occupancy levels, ventilation systems in place). A more detailed description of these environments could help in understanding the generalizability of the study's findings. The study provides a clear overview of the interventions being evaluated, namely the three ventilation strategies and the implementation of the hardware prototype for occupant detection.	The study employs the Wells-Riley model for evaluating the infection risk in public transportation buildings, incorporating parameters such as the probability of infection, breathing rate, quantum generation rate, and exposure time. This model is appropriate for the study's aim.	The authors have published the assumptions of the Wells-Riley model, including specific parameter values. The exposure time is estimated based on common experience, with different durations considered for airport terminals and train stations.	The study references the Wells-Riley equation and provides details on how the probability of infection is calculated. While the exact equations are not explicitly included in the provided excerpts, the references to specific equations and the parameters involved suggest that the formulas associated with the model are acknowledged and utilized in the analysis.	The findings are consistent with the study's objectives of mitigating infection risk and saving energy. The authors also acknowledge limitations such as the potential for occlusion in camera-based detection and the case-dependent nature of parameters in the Wells-Riley model, suggesting further adjustments to the ventilation rate might be necessary in practice to secure a lower infection probability. The acknowledgment of limitations and the presentation of results that align with the study's goals indicate a consistent and logical conclusion based on the methodology and data presented.	**Moderate**
Srivastava, 2021 (61)	The summaries do not provide detailed demographic information about the susceptible population (e.g., age, health status, or density of occupants) which could	The description of the model used for assessing the infection risk of SARS-CoV-2 in a large office building appears to be both complete and appropriate. The studies employ Computational Fluid	The studies have published key assumptions of the model. For instance, they assume a simplified rectangular column to represent an occupant due to computational	The studies mention the use of the Wells-Riley equation for assessing infection risk, and the Eulerian method for the spatial distribution of the virus. However, the specific formulas associated with these methods, including the discretized equations	The results and conclusions presented by the authors appear to be consistent with the methodologies and assumptions described. They explore the effect of air disinfection devices on	**Moderate**

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
	influence the generalizability of the findings. Additionally, while the interventions are described in terms of their general approach (ventilation and UV-C disinfection), specifics regarding the implementation of these strategies (e.g., ventilation rates, placement, and number of UV-C units) are not detailed in the provided text. Such specifics are crucial for understanding the feasibility and potential impact of these interventions in real-world settings.	Dynamics (CFD) to calculate spatial distributions of airflow, air temperature, and SARS-CoV-2 concentration, using the Reynolds-averaged Navier-Stokes (RANS) equations closed with the RNG k-ε model, which is noted for its performance in indoor airflow simulations. Additionally, the Eulerian method is used for predicting the spatial distribution of the SARS-CoV-2 virus, which is appropriate for treating the particle phase as a continuum phase. The Wells-Riley equation is then applied to evaluate the spatial distribution of the infection risk.	constraints, a method validated by previous studies. The quanta value used for SARS-CoV-2 is based on prior data, acknowledging that future studies could reassess infection risk with updated quanta values. These assumptions are critical for understanding the model's limitations and the context in which the findings are applicable.	solved with the SIMPLE algorithm and the Boussinesq approximation for simulating buoyancy effects, are referenced rather than explicitly published in the provided text. This approach is common in scientific literature due to space constraints but may require readers to consult the referenced sources for detailed mathematical formulations.	reducing infection probability, finding that the use of RM3 UV-C units could effectively lower the infection risk to below 2% in certain scenarios.	
Stabile, 2021(62)	The description of the population and interventions seems adequately tailored to the context of classrooms during pandemics, focusing on scenarios typically occurring in such environments. However, the methodology does not presume to cover all possible situations or mitigation solutions, such as the use of more efficient masks, air purifiers, or intermittent occupancy, which could further reduce transmission risk.	The description of the model used in the study appears to be complete and appropriate for the intended application. The methodology involves calculating the required air exchange rates (AER) and airing procedures to maintain an acceptable level of virus transmission risk in classrooms, using virus and CO2 mass balance equations. This approach considers particle deposition, virus inactivation phenomena, and dynamic scenarios within a 5-hour school day. Two different viruses, SARS-CoV-2 and seasonal influenza, were considered under the assumption of airborne transmission only, excluding	The study published its assumptions, including the simplified hypothesis that viruses and CO2 are instantaneously and evenly distributed within the confined space (box-model). It also assumes that the students are adequately spaced to neglect the ballistic deposition of large respiratory particles onto mucous membranes, focusing solely on airborne transmission.	While the study references virus and CO2 mass balance equations and mentions the calculation of air exchange rates and airing procedures, it does not explicitly publish all the formulas associated with the model within the provided text. The authors note that the quanta emission model and its parameters, crucial for evaluating the virus transmission potential, are described in previous papers and not reported in detail for brevity.	The results and conclusions presented by the authors are consistent with the methodology and objectives of the study. They provide a method to support regulatory authorities in safely operating schools during pandemics by assessing required ventilation for both mechanically- and naturally ventilated classrooms. The study acknowledges the complexity of the uncertainty budget of the event reproduction number (Revent) and suggests that further studies are needed for experimental validation and improvement of the virus transmission potential quantification for different ventilation systems.	**Moderate**

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
		symptomatic behaviors like frequent coughing or sneezing. The model also incorporates a feedback control strategy for naturally ventilated classrooms based on exhaled CO_2 monitoring.				
Takahashi,2023 (63)	The study does not provide explicit details about the demographic characteristics of the student population (e.g., age, grade level) or the specific type of schools (e.g., elementary, high school) being simulated. While the focus is on the general school environment, the lack of detailed population description might limit the applicability of the findings to specific school settings or age groups. The description of the interventions is adequately detailed, providing clear insights into the two main strategies evaluated: increasing classroom ventilation rates and customizing school schedules.	The description of the School Virus Infection Simulation Model (SVISM) appears to be both complete and appropriate for the study's objectives. SVISM is an agent-based model designed to simulate the spread of virus infection within a school setting, considering various factors such as the number of students, classroom sizes, air conditioner performance, and school schedules. The model's capability to simulate different school scheduling scenarios and its focus on internal school factors, as highlighted by UNESCO, suggest a comprehensive approach to understanding COVID-19 spread in schools.	The study does publish some of the assumptions of the model. For instance, it assumes that the external factors influencing virus spread can be represented by the number of students infected outside the school per unit time. It also assumes the average time from exposure to COVID-19 to the onset of symptoms, which influences the scheduling scenarios simulated by the model.	The study does publish formulas associated with the model, particularly the use of the Wells–Riley equation to calculate the basic reproduction number of the infection and the probability of infection for each susceptible student. This inclusion of specific formulas provides a mathematical foundation for the model's simulation of virus spread, allowing for a more detailed understanding of how infection risks are calculated within the simulated school environments.	The results and conclusions drawn by the authors seem consistent with the objectives and capabilities of the SVISM. The model's application to simulate various school scheduling scenarios and its evaluation of interventions like changing classroom volumes and air change rates demonstrate its utility in planning for reduced infection probabilities without significant resource investments. The study's focus on the internal factors of schools and the simulation of specific interventions aligns with the identified need for school schedule plans that maintain face-to-face classes while minimizing COVID-19 spread. The consistency between the model's capabilities, the simulated interventions, and the study's conclusions suggests a logical and coherent research outcome.	**Moderate**
Tognon et al., 2023 (64)	The description of the population and the interventions evaluated in the study appears to be adequately detailed for the purpose of the research. The study specifically	The description of the model used in the study is both complete and appropriate. The authors detail the coupling process between TRNSYS and CONTAM for dynamic simulation building	The authors have published the assumptions of the model, which are crucial for understanding the context and limitations of the simulation results. These include the thermal	The study provides specific formulas associated with the model, particularly in the context of evaluating infection risk. The Wells-Riley model is used to estimate airborne infection risk, with the formula for calculating the intake dose based on quanta concentration over	The results and conclusions presented by the authors are consistent with the methodology and analyses described in the study. They analyze the effect of different control strategies on the	**Moderate**

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
	focuses on two types of buildings: a residential building and a school classroom. This choice of settings is relevant as it represents common environments where people spend significant amounts of time, thus making the findings applicable to a wide audience concerned with indoor air quality and energy efficiency. However, the description could be enhanced by providing more details about the specific characteristics of the buildings modeled (e.g., size, occupancy, location) and the exact nature of the control strategies tested (e.g., thresholds for switching between natural and mechanical ventilation, specific conditions under which each mode is preferred). Such details would offer a clearer understanding of the interventions' applicability and potential limitations in real-world settings.	modeling, employing a multi-zonal approach to accurately represent the building spaces. TRNSYS is used for dynamic energy simulation, determining net energy demand for heating and cooling, while CONTAM models' multi-zonal ventilation to calculate natural ventilation flows and air couplings. The case studies—a residential apartment and a school classroom—are described with sufficient detail, including their geometrical characteristics and thermal transmittances, providing a clear understanding of the model's scope and application.	transmittances of external walls and roof covering slabs, the assumption of adiabatic walls separating conditioned spaces, and the internal heat gains from people, appliances, and lights based on European Standard EN 16798:2019. Additionally, the airflow network model for natural ventilation and the transient thermal model assumptions are clearly stated, including the representation of doors and airflow paths through gaps. These assumptions are essential for replicating the study or applying its findings to similar contexts.	exposure time clearly presented. This formula incorporates the breathing flow rate of a susceptible person and the emission rate of COVID-19 quanta, which are critical for assessing the risk of airborne infection in the simulated environments. The inclusion of these formulas enhances the transparency and scientific rigor of the study.	operation of natural and mechanical ventilation, energy demand, electrical absorption by fans, and infection risk extent. The consistency between the study's results and conclusions is well-established, with the findings logically supporting the authors' assertion that well-regulated natural ventilation through a suitable control strategy is beneficial for both energy savings and risk mitigation in hybrid ventilation systems.	
Wang et al., 2021 (65)	While the study mentions high-density indoor environments and public transportation buildings as the primary focus, it does not provide specific details about the characteristics of these environments (e.g., size, typical occupancy	The study employs the Wells-Riley model for evaluating the infection risk in public transportation buildings, incorporating parameters such as the probability of infection, breathing rate, quantum generation rate, and exposure time.	The authors have published the assumptions of the Wells-Riley model, including specific parameter values. The exposure time is estimated based on common experience, with different durations	The study references the Wells-Riley equation and provides details on how the probability of infection is calculated. While the exact equations are not explicitly included, the references to specific equations and the parameters involved suggest that the formulas associated with the model are	The findings are consistent with the study's objectives of mitigating infection risk and saving energy. The authors also acknowledge limitations such as the potential for occlusion in camera-based detection and the case-dependent nature of	**Moderate**

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
	levels, ventilation systems in place). A more detailed description of these environments could help in understanding the generalizability of the study's findings. Intervention Details: The study provides a clear overview of the interventions being evaluated, namely the three ventilation strategies and the implementation of the hardware prototype for occupant detection.		considered for airport terminals and train stations.	acknowledged and utilized in the analysis.	parameters in the Wells-Riley model, suggesting further adjustments to the ventilation rate might be necessary in practice to secure a lower infection probability. The acknowledgment of limitations and the presentation of results that align with the study's goals indicate a consistent and logical.	
Xu et al., 2023 (66)	The description of the population is adequate in the context of the study's focus on U.S. primary schools, providing a clear understanding of the target group for which the trade-off analysis is relevant. However, the interventions to be evaluated, while described in terms of the environment factors to be regulated, could benefit from a more detailed explanation of the specific control strategies and their practical operation ranges. This would enhance the clarity of the interventions' scope and applicability in real-world settings.	The description of the model used in the study is comprehensive and appropriate for the objectives outlined. The study employs a revised Wells-Riley model to simulate airborne transmission, addressing the limitations of current models by considering changes in occupancy and indoor environmental conditions, which are crucial for accurately depicting real-world scenarios in school buildings. Additionally, the Department of Energy (DOE) reference building model is utilized for simulating energy consumption and thermal comfort, tailored to represent a significant portion of the U.S. commercial building stock and modified according to specific standards.	While the study mentions the use of the Wells-Riley and DOE reference building models, it does not explicitly detail all the assumptions inherent in these models within the provided excerpts. For instance, the Wells-Riley model's assumptions about confined space and constant occupancy and environmental conditions are briefly critiqued, suggesting modifications for the study.	The study does not explicitly publish the formulas associated with the revised Wells-Riley model or the DOE reference building model in the provided excerpts. While it mentions the use of these models for simulating airborne transmission, energy consumption, and thermal comfort, specific equations or formulas used in these simulations are not detailed.	The results and conclusions presented by the authors appear to be consistent with the objectives and methodology of their study. These results are consistent with the study's aim to explore the interdependent nature of these factors in building operations. Furthermore, the authors acknowledge several limitations of their study, including its focus on a one-year period and the reliance on simulations of a reference building model, which may not fully capture the complexities of actual situations. Despite these limitations, the study concludes that variations in the set values of environment factors can significantly impact health, energy consumption, and thermal comfort, underscoring the	**Moderate**

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
					importance of considering these tradeoffs in school building operations.	
Xu et al., 2021 (67)	The description of the population and the interventions evaluated in the study appears to be adequately detailed and relevant for the objectives of the research. The focus on U.S. schools provides a clear context for the study, and the nationwide scope ensures that the findings are applicable across a wide range of educational settings. The interventions evaluated are well-chosen, reflecting practical and widely discussed strategies for reducing airborne infection risk in schools. The detailed assessment of these interventions, including the specific mention of MERV 13 filters and the quantification of their effectiveness, provides valuable insights for schools and policymakers.	The description of the model used in the study is comprehensive and appropriate for assessing the airborne infection risk of COVID-19 in U.S. schools. The study employs the Gammaitoni-Nucci (G-N) equation, a variation of the Wells-Riley equation, which is widely adopted for indoor airborne infection risk assessment. This model is suitable for evaluating the risk of airborne diseases like influenza, tuberculosis, and SARS-CoV-2 in indoor environments, including schools. The methodology also incorporates a one-year pandemic scenario to estimate the nationwide prevalence of SARS-CoV-2, considering factors like seasonal variation, duration of immunity, and cross-immunity from other coronaviruses.	The study has published the key assumptions of the model, including the baseline ventilation rate, the height of classrooms, and the number of hours in a typical school day. It also assumes a well-mixed condition of infectious particles throughout the school building, which simplifies the national assessment of school infection risks. However, it acknowledges limitations such as the simplification of particle mixing and the exclusion of room or building separation in schools. While the study outlines several assumptions, it may not exhaustively list all underlying assumptions, such as specific behavioral patterns of students that could affect transmission dynamics.	The study has published the formulas associated with the model, including the G-N equation for calculating infection risk and the equations for estimating variables such as the infection risk, ventilation rate, and the infectiousness parameter for SARS-CoV-2. These formulas are crucial for understanding how the study quantifies infection risk and evaluates the impact of different parameters on this risk.	The results and conclusions of the study appear to be consistent with the methodology and findings presented. The study identifies air filtration as an effective strategy for reducing infection risk, based on the modeling of various intervention strategies and their impact on infection risk. It also conducts sensitivity analysis and Monte Carlo Simulations (MCS) to account for uncertainties in key parameters, which supports the robustness of the findings.	**High**
Xie et al., 2024 (68)	The description of the population and the interventions to be evaluated appears to be adequate. The study covers a comprehensive sample of 111,485 public and private schools across the U.S., providing a broad and representative analysis of the school environment during the COVID-19	The description of the model used in the study appears to be complete and appropriate for assessing the risk of airborne transmission of SARS-CoV-2 in schools. The study employs the Gammaitoni – Nucci (G-N) equation, a variation of the Wells-Riley equation, which is widely adopted for indoor	The authors have published the assumptions of their model, including the use of a one-year pandemic scenario with moderate seasonal forcing, an immunity duration of 10 weeks, and no cross-immunity between SARS-CoV-2 and other coronaviruses.	The study published the formulas associated with the model, including the calculation of infection risk based on the school population and the prevalence of COVID-19, as well as the variables for occupant density, exposure time, and the effect of introducing and circulating fresh air in the building.	The results and conclusions of the authors are consistent with the methodology and analysis presented. The study conducted a sensitivity analysis to quantify the influence of various factors on infection risk and used Monte Carlo Simulation (MCS) to model the impact of parameter uncertainties. The findings regarding the	**High**

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
	pandemic. The interventions evaluated—ventilation improvements, filtration, and hybrid learning—are relevant and practical measures that schools can implement to mitigate airborne infection risk. The inclusion of combined strategies also allows for an assessment of the synergistic effects of multiple interventions, offering schools flexible options based on their specific circumstances and capacities.	airborne infection risk assessment.			effectiveness of different intervention strategies under various scenarios are based on the described model and its assumptions, providing a coherent and logical conclusion to the study's objectives.	
Yan et al., 2022 (69)	The population in question is occupants of a large office building, a common environment where risk mitigation strategies are crucial. The interventions evaluated are comprehensive, covering a range of mechanical and behavioral strategies that can be implemented in similar settings. The study's focus on a DOE prototype office building provides a specific context that helps in understanding the applicability and effectiveness of the proposed mitigation strategies in a real-world scenario.	The description of the model used in the study is both complete and appropriate. The study employs the CONTAM model, enhanced with the "CONTAM-quanta" approach, to estimate airborne virus transmission in terms of quanta and calculate the probability of infection for SARS-CoV-2. This approach is based on the Wells-Riley model, which is a well-established method for evaluating airborne exposure risks. The study further extends the model's application to a multizone building environment, allowing for detailed analysis of airborne transmission risks across different zones within a building.	While the study outlines the general approach and application of the model, there is a lack of explicit detail regarding all the assumptions made within the model. The Wells-Riley equation and the concept of quanta are mentioned, and the study acknowledges uncertainties in estimating the quanta generation rate for SARS-CoV-2 under different conditions.	The study references the Wells-Riley equation. This equation is mentioned in the context of explaining the concept of quanta for airborne transmission. The authors published the formulas associated with the model. For instance, they provided the air mass balance equation to detail the equivalent removal efficiencies used in a building to reduce the aerosol concentration and thus exposure. Additionally, they presented the formula for the time-change rate. These formulas are crucial for understanding the model's approach to estimating airborne virus transmission and evaluating mitigation strategies.	The results and conclusions presented in the study appear to be consistent with the methodology employed and the analysis conducted. The study concludes that the best strategy to keep the risk of infection propagation low, without universal masking, is the operation of in-room GUV or a large industrial-sized PAC. With masking, all strategies were deemed acceptable. These conclusions are consistent with the study's objective to evaluate different mitigation strategies.	**Moderate**
Yuce et al., 2023 (70)	The population, in this case, is represented by a thermal manikin within an	The description of the model used in the studies appears to be both complete and	The studies have published several assumptions related to the model. For instance,	The studies outline the use of the Taguchi method and the Wells-Riley method for risk assessment. The	The results and conclusions of the study are consistent. The study systematically	**Moderate**

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
	office room environment, which serves as a proxy for human presence. However, the studies do not explicitly describe the characteristics of the human population that might occupy such an office room, such as the number of occupants, their activity levels, or their susceptibility to infection. The interventions evaluated include various ventilation parameters such as inlet velocity, inlet temperature, inlet-outlet heights, and room dimensions. The studies provide a clear description of these interventions and their optimization to minimize pathogen transmission.	appropriate for the objectives set forth. The studies detail the dimensions of the office room, the positions of the inlet and outlet, the use of a thermal manikin to simulate human presence, and the inclusion of office furniture like a desk and computer. The use of Computational Fluid Dynamics (CFD) simulations, along with the Taguchi method for optimization, is well-documented. The studies also mention the use of standard k-ε turbulence models with enhanced wall treatment to accurately capture turbulent flow, and the Boussinesq model for buoyancy-driven flow.	the use of CO2 as a tracer gas to model airborne transmission of pathogens assumes that smaller particles behave similarly to tracer gases in airflow patterns. The simplification of boundary conditions and the specific modeling of only the mouth for cross-infection studies are explicitly mentioned.	Taguchi method's calculation procedure, including the establishment of an orthogonal array, computation of signal-to-noise (S/N) ratios, derivation of delta values, and determination of factor order, is described. The Wells-Riley method is mentioned, but specific formulas associated with these methods or the CFD simulations (e.g., equations for airflow, contaminant dispersion) are not detailed.	investigated the impact of various ventilation parameters on pathogen transmission and concentration in indoor environments. Overall, the study maintains a consistent narrative from its objectives through to its conclusions, effectively linking its findings with its stated goals and providing a coherent understanding of the impact of ventilation parameters on indoor pathogen transmission.	
Zafari et al., 2022 (71)	The description of the population and the interventions evaluated appears to be somewhat limited. While the study acknowledges the complexity of factors influencing the transmission of SARS-CoV-2, including the characteristics of the population (e.g., age, gender, race, comorbidity, socioeconomic status), it primarily focuses on the aspect of airborne transmission in indoor spaces without a detailed exploration of these	The description of the model appears to be complete and appropriate for the study's objectives. The model inputs, including the mean year-round prevalence of actively infectious cases in the surrounding community and the proportion of patrons that are vaccinated, are clearly defined. The model also accounts for the temporal evolution of the concentration of viable viral copies in an indoor space under well-mixed conditions, considering the movement of people and airflow patterns.	The authors have published the assumptions of the model, which include the average days of infectiousness for an exposed individual, the assumption of well-mixed conditions in an indoor space, and the behavior of symptomatic COVID-19 cases in terms of quarantine.	While the methodology section and the description of the model inputs and assumptions are detailed, the specific mathematical or computational formulas used to calculate the outcomes (e.g., infections averted, incremental costs, QALYs) are not directly cited.	The results and conclusions presented by the authors appear to be consistent with the objectives and methodology of the study. The model outcomes, including infections averted, incremental costs, and QALYs, are clearly reported for different scenarios (base-case, best-case, and worst-case). The authors' conclusions are supported by the results of the sensitivity analyses and the robustness of the model.	**Moderate**

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
	population characteristics. The interventions evaluated, such as improvements in ventilation, are discussed in the context of their potential to reduce airborne transmission, but the specific characteristics of the population that might be affected by these interventions are not thoroughly described.					
Zafarnejad, 2021 (72)	The description of the population focuses on student demographics and behavioral factors that influence compliance with COVID-19 regulations in a classroom setting. While the summary mentions these factors, it does not provide detailed information on the demographic characteristics of the student population The interventions evaluated in the studies are well-described and relevant to the context of reducing COVID-19 transmission in classroom settings. The interventions include both policy measures (e.g., class schedule adjustments, surveillance testing, contact tracing) and physical measures (e.g., social distancing, ventilation improvements). This comprehensive approach allows for a	The description of the model appears to be both complete and appropriate for the study's objectives. The model incorporates agent-based simulation to evaluate the spread of SARS-CoV-2 in classroom settings, considering factors such as classroom size, layout, and the behavior of students with respect to guideline compliance. It extends traditional transmission models by including the local spread of quanta from a contagious source and accounts for the behavior of students regarding guideline adherence. This comprehensive approach, which integrates both particle and interpersonal levels of transmission risk estimation, is suitable for assessing the impact of various non-pharmaceutical interventions in educational settings.	The authors have published the assumptions of the model, which are crucial for understanding the context and limitations of the simulation. These assumptions include the presence of at least one infected student in the classroom to address the patient zero problem, the effectiveness of masks in providing protection against droplets, and the behavior of students in terms of attending classes while experiencing mild symptoms. Additionally, the model assumes randomized seating in the classroom and does not account for the movement of agents, which could affect transmission dynamics. By disclosing these assumptions, the authors enable readers to gauge the model's applicability and potential limitations in real-world scenarios.	While the authors discuss the methodology and assumptions behind their model, the specific formulas associated with the model are not detailed. The description focuses on the conceptual framework and the factors considered in the simulation, such as classroom layout, student behavior, and intervention strategies. For a thorough evaluation of the model's scientific rigor, access to the detailed mathematical formulas and computational algorithms would be necessary. However, the summary indicates that the source code and related information are available online, which suggests that interested readers can access the technical details of the model.	The results and conclusions presented by the authors appear to be consistent with the objectives and methodology of the study. They found that traditional transmission models tend to underestimate infection rates compared to their approach, which considers the local spread of quanta and behavioral factors.	**Moderate**

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
	nuanced understanding of how different strategies can contribute to reducing transmission risk. The description of interventions is adequate for understanding the scope of the study and the potential impact of various measures on COVID-19 spread.					
Zand, 2023(73)	The description of the population and the interventions to be evaluated is adequately detailed, providing a clear understanding of the study's scope and the specific measures under investigation. The focus on a vulnerable population within a specialized school setting adds a valuable dimension to the research, addressing an area that is often underrepresented in studies of this nature. The comprehensive detailing of the interventions, particularly the emphasis on ventilation improvements and the specific characteristics of the HVAC systems, allows for a nuanced understanding of the potential impact of these measures on reducing the spread of SARS-CoV-2.	The description of the model used in the study appears to be complete and appropriate for the objectives outlined. The authors employed the NonlinearModelFit function in Mathematica with the Levenberg-Marquardt algorithm option to estimate the room airflow needed to achieve 4 air changes per hour (ACH), based on the volume of the room. This approach is suitable for the complex nature of airflow dynamics and the need for precise estimation of ACH to assess ventilation effectiveness in mitigating SARS-CoV-2 transmission. The use of curve fitting to estimate ACH from CO2 time series data further supports the appropriateness of the model for the study's aims.	While the study provides a detailed methodology for estimating ACH and mentions the use of specific algorithms and functions, it does not explicitly detail all the assumptions inherent in the model used. For instance, assumptions regarding the uniformity of air mixing within the rooms or the impact of occupancy and room usage patterns on CO2 levels and ACH estimations are not explicitly stated.	The authors have published the formula used to estimate ACH, which involves dividing the room volume by 4 and applying the NonlinearModelFit function to CO2 time series data. They also describe the process of identifying peaks and valleys in CO2 levels and fitting Equation 1 to these data points to estimate ACH. This level of detail provides a clear understanding of how ACH estimates were derived, which is crucial for replicating the study or applying its methodology in similar research	The results and conclusions presented by the authors appear to be consistent with the methodology and data analysis employed in the study. They sampled 100 rooms across three buildings with varying HVAC systems and assessed the impact of ventilation, among other mitigation measures, on SARS-CoV-2 transmission. The analysis showed a correlation between increased ACH or reduced exposure to high CO2 levels and lower incidence of positive SARS-CoV-2 PCR tests, supporting the hypothesis that improved ventilation can mitigate virus transmission in school settings.	**Moderate**
Zheng, 2021 (74)	The study primarily focuses on the physical aspects of building design (i.e., the presence and	The description of the model used in the study is both complete and appropriate. The authors provide detailed	The study published the assumptions of the model, including the adoption of a 1:15 reduced scale for the	The authors published the formulas associated with the model, including the general form of time-averaged governing equations for incompressible	The results and conclusions of the authors appear to be consistent with the methodology and the data	**High**

LES 15.2: Effectiveness of VADF for reducing transmission of RIDs in non-health care community-based settings.

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
	positioning of shading louvers) and its impact on airflow and pollutant dispersion. As such, it does not directly involve human subjects or populations in the traditional sense. Instead, the "population" in this context refers to the simulated environment of a multi-storey building and its units. The interventions evaluated are the configurations of shading louvers on the building's exterior. The study investigates how different placements (windward vs. leeward) and the presence of these louvers affect ventilation, pollutant dispersion, and the potential risk of airborne infection transmission within the building.	information about the geometric model of a multi-storey building with external louvers, specifying dimensions and configurations for both shaded and non-shaded cases. They also describe the computational domain and boundary conditions, ensuring the model's relevance to real-world scenarios. The selection of the realizable k-ε turbulence model is justified with references to its agreement with experimental data and its suitability for investigating airflow characteristics and pollutant dispersion around buildings with facade components.	building, the simplification of airflow connections between units, and the specific configurations of the louvers. The boundary conditions and the computational domain's specifications are based on practical guidelines and standards to simulate airflow characteristics accurately. The use of steady Reynolds-averaged Navier-Stokes equations (RANS) for incompressible flow is mentioned, which balances accuracy and computational consumption. These assumptions are crucial for understanding the model's limitations and the context in which the results are valid.	flow and the discretization method using the finite volume method (FVM). The selection of turbulence models and the rationale behind choosing the realizable k-ε model over others are discussed, with references to its effectiveness in capturing airflow and pollutant dispersion. This transparency in sharing the mathematical foundation of the model enhances the study's credibility.	presented. The study validates the CFD methods with wind-tunnel experiments and experimental measurements of airflow velocity at openings, ensuring that the model accurately predicts airflow exchange and tracer gas concentration in a shaded building. The solver settings and convergence criteria are clearly defined, supporting the reliability of the simulation results.	

LES 15.2: Effectiveness of VADF for reducing transmission of RIDs in non-health care community-based settings.

Study	Description of the population and the interventions is complete and appropriate	Description of the model to be used is complete and appropriate	Published Assumptions of the Model	Published Formulas Associated with the Model	Results and Conclusions Consistency	Confidence
Tapia-Brito, 2023	The description of the population is notably absent. The study does not specify the indoor environments or the target population where the MopFan system was tested. For a comprehensive evaluation, it would be essential to know details such as the size of the rooms, the typical pollutant levels, the presence of individuals with respiratory issues, or any specific characteristics of the households that could influence the effectiveness of the air purification system. In conclusion, while the interventions are well-described and the methodology appears robust in terms of developing and testing the air purifying system, the lack of detailed information about the population and the specific indoor environments tested limits the ability to fully evaluate the applicability and effectiveness of the MopFan in real-world settings. Future work should include detailed descriptions of the testing environments.	The description of the model used in the study is detailed and appears appropriate for the objectives set forth. The study employs Computational Fluid Dynamics (CFD) simulations to understand the flow characteristics within the air purifying device, using ANSYS Fluent R2021 and applying different turbulent models, with the RNG k-ε chosen for good convergence. The model aims to analyze the effect of stationary versus rotating brushes on air flow and pollutant distribution within the device.	The study mentions the use of turbulent models and the specific setting of convergence criteria (set as 10^-6 for continuity, conservation of momentum, and turbulent equations). However, while it indicates the application of these models and criteria, it does not fully detail all assumptions underlying the model, such as assumptions about the physical properties of the air, the specific characteristics of the pollutants, or the indoor environment conditions during simulations. Without these assumptions being explicitly published, it's challenging to fully assess the model's applicability and limitations.	The study references the governing equations related to the simulations found in another reference. While it indicates that these equations are foundational to the CFD simulations conducted, the direct formulas associated with the model, such as those governing the photocatalytic purification reaction or the specifics of the turbulent models applied, are not provided within the text. This omission makes it difficult to fully evaluate the mathematical underpinnings of the model and its implementation.	The results, as presented, demonstrate the effectiveness of the MopFan design in reducing VOCs and formaldehyde using different materials and compare the performance of static versus spinning brushes. The study also discusses the potential for energy savings and lower operating costs through optimized filter geometry. These outcomes align with the study's objectives to find the optimal MopFan configuration and improve air purifier efficiency. However, without full visibility into the model's assumptions and the specific formulas used, there's a limitation in assessing the direct linkage between.	**Low**

Arjmandi, 2022	The study primarily focuses on the technical aspects of ventilation system design and optimization within a classroom environment, aiming to reduce the transmission of airborne pathogens. While the methodology is detailed in terms of the technical processes and simulations involved, there is a lack of specific description regarding the population that would benefit from these interventions. The study implicitly targets students and staff within educational institutions by focusing on classroom settings, but it does not explicitly describe this population or their specific characteristics (e.g., age, health status). Similarly, the interventions evaluated—namely, the different configurations of ventilation systems—are described in terms of their technical specifications.	The description of the model used in the study is both complete and appropriate. The study employs Computational Fluid Dynamics (CFD) simulations using the Reynolds Averaged Navier Stokes (RANS) approach, with geometry and mesh created in ANSYS Design Modeler and ANSYS Meshing, respectively. A grid sensitivity study was conducted to ensure the accuracy of the simulations, and the commercial CFD code ANSYS Fluent 2020 R3 was utilized for analysis. The model was validated against measurements from an experimental study, ensuring its reliability.	While the study provides a detailed description of the model setup and validation process, it does not explicitly list all the assumptions made during the modeling process in the provided excerpts. CFD studies typically involve assumptions related to boundary conditions, turbulence models, and properties of the fluid and particles. Although the methodology section outlines the approach and validation, a comprehensive list of assumptions inherent to the CFD model and the specific conditions of the simulations (e.g., assumptions about particle behavior, air properties) is not explicitly provided in the cited text.	The excerpts do not provide specific formulas associated with the CFD model, such as those governing the motion of particles, fluid dynamics equations, or the specific equations used for the optimization process. While the study mentions the use of the RANS approach and the validation of the model against experimental data, detailed formulas and mathematical expressions directly associated with the model's governing equations and optimization techniques are not included in the provided text. The study does mention employing a Design of Experiment (DOE) procedure and the response surface method (RSM) for optimization, but without presenting the specific formulas.	The results and conclusions of the study appear to be consistent with the objectives and methodology described. The study aimed to evaluate different ventilation strategies in a classroom setting to minimize the risk of infectious exposure and improve thermal comfort. By employing CFD simulations, conducting a grid sensitivity study, and optimizing the ventilation system using DOE.	**Low**

Khan, 2021	The description of the population involved in the study is minimal, mentioning only that the study was conducted in an occupied home with three occupants. There is no detailed information about the occupants (e.g., age, health status, or activity patterns), which could influence the generalizability of the findings. Understanding the characteristics of the occupants is crucial, as their behavior and presence could affect indoor air quality and the effectiveness of the tested interventions. The description of the interventions is adequately detailed, providing clear information on the different strategies tested for containing airborne contaminants. In summary, while the description of the interventions is thorough and provides a solid foundation for understanding the study's approach to evaluating indoor air quality and containment strategies, the description of the population is lacking in detail. This omission could limit the applicability of the findings to broader populations or different living environments. Future studies could benefit from a more comprehensive	The methodology section provides a detailed description of the interventions and the primary metric used to evaluate the containment effectiveness of various ventilation strategies in a home setting. The use of smoke generated PM2.5 as a marker for virus transmission potential within the isolation zone is clearly explained, along with the rationale for selecting PM2.5 as a surrogate marker. This detailed description of the test setup and the metrics used for evaluation suggests that the model description is complete and appropriate for the study's objectives.	The study implicitly assumes that PM2.5 can act as a carrier for viruses like SARS-CoV-2 and that managing the concentration and movement of PM2.5 within indoor environments can help in controlling virus transmission. While the study mentions the use of PM2.5 as a marker and references the potential for airborne particles to play a significant role in respiratory virus transmission, it does not explicitly list all assumptions related to the model's application to virus containment. Therefore, it appears that not all assumptions of the model are fully published or detailed.	The provided excerpts do not explicitly mention, or detail specific formulas associated with the model used to evaluate the interventions. The study focuses on the practical application of various ventilation strategies and their impact on differential pressure and PM2.5 concentrations rather than mathematical modeling or the use of specific formulas to predict outcomes. Therefore, it seems that the publication does not provide formulas associated with the model.	The study's conclusions about the effectiveness of different ventilation strategies in containing PM2.5 within the IZ are based on observed differential pressures and PM2.5 concentration measurements. The findings that certain configurations were unable to create the desired depressurization in the IZ under specific conditions are directly linked to the measured outcomes and the established criteria for containment effectiveness (e.g., ASHRAE Standard 170's pressure differential requirement). This suggests that the results and the authors' conclusions are consistent with the methodology employed and the data collected during the study.	**Low**

Zhu, 2020	The study's population appears to be college students residing in two dormitory buildings with different ventilation systems. However, the description lacks specific details about the demographic characteristics of the participants (e.g., age, gender, health status), which could influence the generalizability of the findings. Understanding the population's demographic makeup is crucial for assessing the study's applicability to broader or different groups. The description of the interventions is adequate in terms of the operational aspects (e.g., monitoring CO2 levels, comparing buildings with different ventilation systems). However, the study could benefit from a more detailed explanation of how often and under what conditions windows and doors were opened, as well as any guidance provided to the residents regarding this intervention. This information is vital for replicating the study and understanding the feasibility and effectiveness of such interventions in real-world settings.	The description of the multi-zone models used for the dormitory buildings is detailed and appears appropriate for the study's objectives. The models were created based on floor plans, mechanical schedules, ventilation networks, and system test reports, incorporating building geometry, air infiltration paths, and mechanical ventilation system paths. The HVB model included 229 zones, while the LVB model had 529 zones, indicating a comprehensive representation of the buildings' layouts and ventilation characteristics. This detailed setup suggests that the model description is both complete and appropriate for evaluating ventilation rates and the potential for cross-contamination of influenza A viruses in the dormitory buildings.	The text does not explicitly detail all the assumptions underlying the multi-zone models. However, it is mentioned that the multi-zone modeling method is widely accepted for predictions of air infiltration rates, ventilation, and contaminant concentrations, assuming well-mixed air is applicable. This suggests that an assumption of well-mixed air within each zone might be inherent in the methodology, but a comprehensive list of all model assumptions is not provided in the cited text.	Published Formulas Associated with the Model: The provided excerpts do not include specific formulas associated with the multi-zone models. While the methodology and the process of model calibration using CO2 concentrations are described, the actual mathematical or computational formulas used to calculate ventilation rates, air flow paths, or the simulation of influenza spread are not detailed in the provided text.	The findings are consistent with the study's objectives and the capabilities of the multi-zone models as described. The conclusions drawn by the authors, emphasizing the importance of ventilation rates in ARI transmission and the utility of multi-zone modeling in assessing exposure risks, align with the presented results, indicating consistency between the results and the authors' conclusions.	**Low**

Geng, 2023	The description lacks detailed information about the following: Population Specifics: There is no explicit mention of the diversity of the population involved, such as age, health status, or other demographics that could influence the study's applicability to real-world settings. Understanding the population is crucial for assessing the intervention's effectiveness across different groups. Intervention Details: While the study outlines the use of a downward uniform flow field and mentions the optimization of air diffuser design, it does not provide detailed specifications of the air purification device proposed. Information on the exact nature of the machine learning algorithm used for predicting the flow field is also missing. More detailed descriptions of these interventions would be beneficial for replicability and for assessing their practical applicability. Environmental Variables: The study does not explicitly state if it accounted for various environmental variables that could affect aerosol dispersion, such as room size, the presence of furniture, or ventilation systems other than the proposed device. These factors are critical for evaluating the intervention's effectiveness in diverse settings.	The description of the model used in the study is comprehensive and appropriate for the objectives outlined. The study employs Computational Fluid Dynamics (CFD) simulations alongside a machine learning algorithm, specifically Support Vector Regression optimized with Particle Swarm Optimization (SVR-PSO), to optimize the design of air diffusers for minimizing aerosol particle dispersion in indoor environments. The CFD simulations utilize the renormalization group k-ε model for turbulent airflow and the Boussinesq model for buoyant airflow, which are validated models for indoor airflow studies. The integration of CFD with machine learning (MLA) for design optimization represents a novel approach that effectively reduces computational costs. Therefore, the model's description as a combination of CFD simulations and machine learning for design optimization is both complete and appropriate for the study's goals.	The study does not explicitly detail all the assumptions underlying the CFD model and the machine learning algorithm. While it mentions the use of specific models for turbulent and buoyant airflow, which implies certain standard assumptions in fluid dynamics simulations, it does not explicitly list these assumptions. Similarly, while the use of machine learning for optimization is described, the specific assumptions behind the SVR-PSO algorithm's application to this problem are not detailed. Therefore, it can be concluded that not all assumptions of the model are published or clearly stated.	The study provides some formulas related to the CFD simulations, such as those involving the renormalization group k-ε model and the Boussinesq model for simulating airflow. However, the detailed mathematical formulations behind the machine learning algorithm, specifically the SVR-PSO, including how it integrates with the CFD data, are not fully elaborated. While there is mention of the Gaussian kernel function used in SVR and the optimization process of PSO, the complete set of formulas that underpin the entire modeling process is not comprehensively published.	The results and conclusions presented in the study appear to be consistent with the methodology and objectives. The study successfully optimizes the design of air diffusers to achieve a downward uniform flow field, reducing the dispersion of aerosol particles in indoor environments.	**Low**

Xie, 2023	Evaluation of Population and Intervention Description The description of the population in the study is somewhat limited, as it focuses on a generic scenario involving two people dining at a table without specifying demographic details such as age, health status, or other factors that could influence susceptibility to infection. While this generic approach allows for broader applicability of the findings, a more detailed description of the population could enhance the understanding of how specific groups might be affected differently by the ventilation strategies. The interventions evaluated, namely the displacement and mixing ventilation strategies, are adequately described in terms of their relevance to controlling airborne infection risks in restaurant settings. Overall, while the population description could benefit from more detail, the interventions (ventilation strategies) are well-defined and evaluated in a manner that is likely to yield practical recommendations for improving ventilation design in restaurants to prevent disease transmission.	The description of the model used in the study is comprehensive and appropriate for the objectives outlined. The study simulates a common scenario in a restaurant with two people dining at a table, specifying the dimensions of the room and the table, as well as the positioning of two thermal breathing manikins to represent an infected source and a susceptible person. The study further details the computational mesh used for displacement and mixing ventilation cases, with approximately 3.8 million and 3.5 million elements, respectively, indicating a thorough approach to resolving the flow field. The use of CO_2 as a tracer gas and the specific conditions under which the ventilation strategies were analyzed (e.g., air exchange rates, diffuser velocities) are also specified. This level of detail supports the appropriateness of the model for evaluating the effectiveness of different ventilation strategies in reducing respiratory infectious disease transmission in a restaurant setting.	The study acknowledges several assumptions made in the modeling process. It mentions that all of the walls were assumed to be adiabatic and that the study considered a steady state expired jet without accounting for factors such as air conditioning filtration performance, boiling, humidity, evaporation of droplets and particles, and radiation. While these assumptions are crucial for simplifying the model, the authors also caution that these simplifications are limitations and that the results should be interpreted with caution. This transparency in publishing the model's assumptions allows readers to understand the scope and limitations of the findings.	The study utilizes the Wells-Riley model to assess the infection risk, referencing the original proposal of the Wells-Riley equation for studying the airborne spread of diseases like measles. However, the specific formulas associated with the Wells-Riley model or how it was adapted to assess the infection risk in this particular study are not detailed in the provided excerpts.	The results and conclusions presented in the study appear to be consistent with the objectives, but methodological limitations do not allow their generalization.	**Low**

Zhang, 2022	The description of the population in this study is somewhat implicit, focusing on a simulated environment rather than a specific demographic group. The "population" in this context refers to the hypothetical occupants of a quarantine hotel room where the aerosol transmission experiments were conducted. While the study does not describe these individuals directly, it is understood that the findings are meant to apply broadly to individuals staying in similar quarantine facilities. The description of the interventions is adequate in the context of the study's objectives. The focus is on assessing the role of building ventilation and air conditioning systems in mitigating the risk of aerosol transmission, which is a critical aspect of public health measures in quarantine facilities. However, the study could benefit from a more detailed description of the specific features and operational settings of the ventilation systems evaluated, as well as any sanitation measures implemented alongside these systems. This additional detail would provide a clearer understanding of the interventions' potential effectiveness and applicability in real-world settings.	The description of the model used in the study appears to be complete and appropriate for the objectives of the study. The model incorporates various scenarios of aerosol transmission, including simulated respiration and the influence of building ventilation systems such as fan coil units and fresh air conditioning systems. The study also considers the behavior of occupants, such as opening doors to throw away garbage or receive food, which could affect aerosol dispersion. The inclusion of different room scenarios and the detailed setup for aerosol detection through fluorescent microspheres provide a comprehensive framework for understanding aerosol transmission in a quarantine hotel setting.	While the study outlines the experimental setup and scenarios, it does not explicitly detail all the assumptions underlying the model. For instance, the assumptions regarding the behavior of aerosols in different ventilation conditions or the specific characteristics of the fluorescent microspheres as surrogates for viral particles are not fully detailed. However, the study does imply assumptions related to aerosol behavior in ventilation systems and the impact of human activities on aerosol spread.	The provided excerpts do not mention specific formulas associated with the model used for aerosol transmission. The study focuses on the experimental setup, sample collection, and the detection of fluorescent microspheres in various scenarios. While the methodology for monitoring aerosol concentration and the collection of samples is described, the absence of explicit formulas or mathematical models for aerosol dispersion or transmission analysis is noted. This could be a limitation if the study aims to provide a quantitative analysis of aerosol transmission risks.	The results, as indicated by the detection of fluorescent microspheres in various locations and under different scenarios, suggest that aerosol transmission is a concern in the studied quarantine hotel setting, especially considering the ventilation systems and human activities. The findings regarding the positive detection of microspheres in different rooms and the potential for vertical transmission through bathroom and pipeline systems support the study's concerns about aerosol transmission risks. These results seem consistent with the study's objectives.	**Low**

Katal, 2022	The description of the population and the interventions evaluated in the study appears to be adequately detailed for the study's scope. The population, in this case, is implicitly defined as individuals occupying various types of buildings (as classified by the building archetypes) during the COVID-19 pandemic. While the study does not specify demographic details of the population, such specificity may not be necessary given the focus on indoor environments rather than individual characteristics. The interventions evaluated are well-described and relevant to the study's aim of improving indoor air quality to reduce COVID-19 transmission. The six mitigation measures (wearing face masks, reducing occupancy, improving ventilation, etc.) cover a broad range of strategies, from individual actions to systemic building modifications. This comprehensive evaluation allows for a nuanced understanding of each intervention's effectiveness and its implications for energy consumption. However, the study could benefit from a more detailed description of how these interventions are implemented within the different building archetypes and any assumptions made about compliance and usage patterns. Additionally, considering the variability in building types and usage.	The description of the model used, which integrates CityRPI and CityBEM, is adequately detailed for understanding its purpose and functionality. CityRPI calculates the airborne infection risk of COVID-19 in buildings, while CityBEM assesses the impact of different strategies on buildings' peak energy demand. The methodology section provides a schematic of the CityRPI model and mentions its integration with CityBEM for a comprehensive analysis of infection risk and energy consumption. However, the detailed mechanics of CityBEM, such as the transient heat balance equations and the modeling of the HVAC system, are not included in the main text but are available in the supplementary material. This approach is appropriate given the complexity of the models and the need to keep the main text concise.	The assumptions underlying the model are not explicitly detailed in the provided excerpts. While the methodology mentions the use of archetype buildings based on publicly available data, standards, and codes, specific assumptions regarding occupancy, human behavior, or compliance with mitigation strategies are not discussed. The reliance on archetype buildings implies assumptions about uniformity in building types and their usage, but the exact nature of these assumptions is not fully disclosed.	The provided excerpts do not include specific formulas used in the CityRPI or CityBEM models. While the general approach and the types of calculations performed by these models are described (e.g., calculating airborne infection risk, heating/cooling loads, and energy consumption), the actual mathematical formulas or algorithms are not presented.	The results and conclusions presented in the study appear to be consistent with the objectives, but methodological limitations do not allow their generalization.	**Low**

Banholzer, 2023	The interventions evaluated, namely the use of air cleaners to reduce respiratory infections, are mentioned in a general sense without detailing the technology or models of air cleaners used, their placement within the school environments, or the metrics used to assess air quality improvements and reductions in infection rates. For a comprehensive assessment of the study's methodology and its applicability to broader contexts, it would be essential to have detailed information on how the study was designed and executed, including the characteristics of the participants and the operational specifics of the intervention. This information is crucial for understanding the study's relevance, replicability, and the generalizability of its findings. Without these details, readers cannot fully assess the validity of the study's conclusions or the potential impact of air cleaners in similar settings.	The description of the models used in the study appears to be complete and appropriate for the objectives of the study. The authors employed Bayesian log-linear regression models to estimate the reduction in particle concentrations with air cleaners, adjusting for observed confounders. For estimating the relative risk of infection, they used a Bayesian latent variable regression model, modeling the number of new respiratory cases with a Negative Binomial distribution. Additionally, they utilized a Bayesian Negative Binomial regression model to estimate the reduction in the daily number of coughs with air cleaners. These models are suitable for analyzing count data and accommodating overdispersion, which is common in epidemiological data, thus indicating that the model descriptions are both complete and appropriate for the study's aims.	The assumptions underlying the models are not explicitly detailed in the provided excerpts. While the statistical approaches and the use of Bayesian models suggest certain underlying assumptions (e.g., prior distributions, likelihood functions), specific assumptions related to the models' application to the study data (such as the distribution of the data, independence of observations, or linearity of relationships) are not directly mentioned.	The authors published key formulas associated with their models. For instance, they provided the formula used to estimate the number of new infections in relation to the presence of air cleaners, incorporating variables such as the number of infections in the previous week, the cumulative number of infections, and the effect of air cleaners adjusted for class-specific effects and other factors. This indicates that they have published critical formulas associated with their models, aiding in the transparency and reproducibility of their findings.	The results and conclusions presented in the study appear to be consistent with the objectives, but methodological limitations do not allow their generalization.	**Low**

Park, 2021	The description of the population and the interventions evaluated in the study appears to be adequately detailed for the study's objectives. However, some specifics about the population, such as the number of classrooms, the average number of students per classroom, and the age group of the students, were not explicitly mentioned. These details could provide additional context to understand the applicability and scalability of the findings. The interventions evaluated, including the comparison between cross-ventilation and single-sided ventilation, the use of masks, and the analysis of exposure times, are well-described and relevant to the study's aim of preventing COVID-19 transmission in school settings. The inclusion of power consumption analysis adds value by addressing the practical implications of implementing the recommended ventilation strategies. Overall, while the description of the interventions is comprehensive and directly tied to the study's objectives, a more detailed description of the population could enhance the understanding of the study's applicability and generalizability.	The model used in the study is based on the Wells-Riley equation, which is a recognized method for evaluating the airborne infection risk. This model incorporates the concept of quantum to implicitly consider various factors such as infectivity, infectious source strength, and the biological decay of pathogens. The description of the model appears to be complete and appropriate for the study's objectives, given the Wells-Riley equation's established use in assessing airborne transmission risks.	While the citations provided do not explicitly list all the assumptions of the Wells-Riley model, the nature of the model itself implies certain assumptions, such as a well-mixed room and a constant rate of quanta generation. However, without explicit mention in the provided excerpts, it's unclear if all assumptions specific to their application of the model (e.g., mask filtration efficiency, room occupancy) were fully disclosed.	The excerpts provided do not include the specific formula of the Wells-Riley equation as applied in their study. The Wells-Riley equation is mentioned as the foundation of their infection risk evaluation, but the actual formula, including any modifications or parameters specific to their study (e.g., adjustments for mask use, ventilation rates), is not provided in the excerpts.	The results and conclusions presented in the study appear to be consistent with the objectives, but methodological limitations do not allow their generalization. The consistency and validity of the results and conclusions would ultimately depend on how accurately and transparently the model was applied, including any study-specific modifications and the robustness of the data collected .	**Low**

Faulkner, 2023	The description of the population and the interventions to be evaluated in the study appears to be adequately detailed for the purpose of the research. The population in question is the occupants of a medium-sized office building, which is a relevant and practical choice given the widespread concern about indoor air quality in workplace environments during the COVID-19 pandemic. The choice of a building in a cold and dry climate adds specificity to the study, as these environmental conditions can significantly affect HVAC performance and energy consumption. However, the paper could enhance its methodology section by providing more detailed information about the building's occupancy patterns, such as the number of occupants, their distribution within the building, and their activity levels. These factors can significantly influence the generation and concentration of airborne viruses.	The description of the model used in the study is comprehensive and appropriate for the objectives outlined. The model integrates multiple components, including a multizone airflow model, a Variable Air Volume (VAV) system model, a control system, and weather conditions, to simulate the impact of HVAC operation strategies on virus transmission and energy consumption in office buildings. The inclusion of virus generation, decay, and removal by HVAC filters within the model is particularly relevant for assessing strategies to mitigate airborne virus transmission, such as SARS-CoV-2.	The assumptions underlying the model are not explicitly detailed in the provided excerpts. While the methodology section describes the components of the model and its application, specific assumptions regarding the HVAC system's operational parameters, occupancy patterns, or virus transmission dynamics are not fully disclosed. For a thorough evaluation, assumptions such as the efficiency of the hot water system, the efficiency and pressure drop characteristics of HVAC filters, and the generation and decay rates of the virus are crucial.	The excerpts provide some formulas associated with the model, particularly regarding the removal of the virus by HVAC filters, described by the equation for calculating virus concentration exiting the filter based on filter removal efficiency. However, the descriptions do not comprehensively cover all formulas or mathematical relationships employed within the model, such as those related to virus generation, decay, or the specific control algorithms for the HVAC system components. While the mention of the filter efficiency formula is valuable, a more detailed exposition of the mathematical underpinnings of the model would enhance the understanding of its operation and capabilities.	The results and conclusions presented in the study appear to be consistent with the objectives, but methodological limitations do not allow their generalization.	**Low**

Wang, 2022	The description of the population and the interventions evaluated in the study appears to be adequately detailed for the study's objectives. However, the description could be enhanced by providing more detailed information about the specific characteristics of the theatres (e.g., size, typical occupancy levels, types of events hosted) and the exact nature of the ventilation systems in place (e.g., mechanical vs. natural ventilation, air filtration capabilities). Additionally, details on how occupancy levels were varied or controlled during the study would offer deeper insights into the interventions' impact on air quality and disease transmission risk. In summary, while the study provides a solid foundation for understanding the role of ventilation in mitigating COVID-19 transmission risk in theatres, a more detailed description of the population characteristics and the interventions evaluated would further strengthen the findings' applicability and relevance.	The methodology section provides a detailed description of the field study process, including CO2 monitoring and microbiological data collection at live events in theatre auditoria. The study utilized non-dispersive infrared (NDIR) sensors for CO2 measurement and considered variables such as occupancy, event management, and performance times. However, it does not explicitly describe a predictive or analytical model for assessing ventilation effectiveness or the risk of SARS-CoV-2 transmission based on these measurements. Therefore, while the methodology for data collection is well-described, the description of a specific model for analysis, if used beyond direct measurement interpretation, is not detailed.	The study acknowledges uncertainties associated with modelling assumptions, indicating that there are underlying assumptions in their analysis or interpretation of data. However, specific assumptions related to a model are not detailed in the provided text. For example, it is mentioned that any increase in CO2 concentration above expected ambient levels was attributed to human exhalation, which is an assumption in interpreting CO2 data. Still, comprehensive assumptions that would be part of a detailed model are not explicitly published.	The provided excerpts do not include specific formulas associated with a model for evaluating ventilation effectiveness or the risk of SARS-CoV-2 transmission. While the methodology for data collection and the criteria for indoor air quality (IAQ) classification are described, the absence of explicit formulas or a detailed analytical model in the provided text suggests that the focus is on empirical measurement and classification rather than on a formula-based predictive model.	The study's results regarding CO2 concentrations and microbiological findings, such as the presence of bacteria and SARS-CoV-2 virus in air samples, are used to discuss the effectiveness of ventilation in theatre settings and the potential risk of disease transmission. The acknowledgment of limitations and the suggestion for further work indicate a level of consistency and caution in interpreting the findings. The results and conclusions presented in the study appear to be consistent with the objectives.	**Low**

Vouriot, 2021	The study's population is adequately described in terms of the setting (school classrooms) and the geographical location (England). However, the description lacks specific details about the demographics of the students and staff within these classrooms, such as age ranges, which could influence the generalizability of the findings. Understanding the population's demographics is crucial as it can affect the transmission dynamics of airborne diseases like COVID-19. Interventions Evaluation The study implicitly evaluates an intervention by assessing the impact of ventilation on the risk of airborne infection. However, it does not explicitly describe any specific interventions implemented to improve ventilation or reduce infection risk, such as the introduction of air purifiers, increased outdoor air exchange, or changes in classroom occupancy. A more detailed description of evaluated interventions, if any were specifically tested or recommended based on the CO2 monitoring, would enhance the understanding of actionable measures that schools can take to mitigate airborne infection risks.	The model used for assessing airborne infection risk in school classrooms is based on the Wells-Riley approach, which is a well-established method for estimating the probability of infection from airborne pathogens. The study specifically focuses on determining appropriate quanta generation rates for SARS-CoV-2 in school settings, acknowledging the difficulty in quantifying this parameter due to its variability with disease, individuals, and activity levels. The description of the model, including its application to CO2 monitoring for estimating the number of secondary infections, is adequately detailed, making it appropriate for the study's objectives. The methodology's adaptability to various airborne diseases further supports its appropriateness .	The study acknowledges the inherent uncertainties in using CO2 measurements to infer the risk of airborne infection, such as the choice of sensor location and the sensor itself. It also discusses the uncertainties introduced by the choice of quanta generation rate, which is a critical factor in the Wells-Riley approach. However, while the study mentions these uncertainties, it does not provide a comprehensive list of all model assumptions explicitly. For instance, assumptions related to the uniformity of aerosol distribution, or the impact of mask-wearing and other mitigation measures are not detailed.	The study does not explicitly detail the formulas associated with the Wells-Riley model or the specific calculations used to estimate the risk of airborne infection based on CO2 levels and quanta generation rates within the provided citations. While it discusses the selection of a quanta generation rate and its implications, the absence of explicit formulas and calculation methods in the provided text limits the ability to fully evaluate the model's application and reproducibility.	The results highlight significant seasonal variations in airborne infection risk due to changes in ventilation rates, with January being nearly twice as risky as July. These findings are consistent with the study's focus on ventilation and CO2 monitoring as indicators of airborne infection risk. The study concludes that the methodology can estimate the number of secondary infections for airborne transmission and is applicable to a wide range of airborne diseases .	**Low**

Vita, 2023	The description of the population and the interventions evaluated in the study appears to be adequately detailed for the purpose of assessing airborne infection risk. The use of mannequins to represent occupants provides a realistic simulation of human heat emissions, which is a critical factor in modeling airflow and pathogen dispersion. However, the study does not explicitly detail the characteristics of the population (e.g., number of occupants, their activities) beyond the use of mannequins. Understanding the specific behaviors and density of occupants could further refine risk assessments. The interventions evaluated, such as changes in ventilation rates and window opening, are relevant and practical measures for reducing airborne infection risk. The study's approach to assessing the impact of these interventions through sensitivity studies allows for a nuanced understanding of how different strategies can affect indoor air quality and infection risk. However, the description could be enhanced by providing more details on the range of interventions considered and the criteria for their selection.	The description of the model used in the study is comprehensive and appropriate for the objectives outlined. The methodology combines Dynamic Thermal Modelling (DTM) and Computational Fluid Dynamics (CFD) to assess airborne infection risk in buildings. The DTM model is detailed with thermal zones and considers seasonal, daily, and hourly variations in weather conditions, which inform the boundary conditions used in the CFD model. The CFD model incorporates detailed building geometry, surface temperatures from the DTM model, and preliminary characteristics of the ventilation system. This dual-model approach is suitable for investigating the performance of ventilation systems concerning airborne infection risk, leveraging the strengths of both DTM and CFD to overcome their individual limitations .	The study outlines several assumptions, including the use of mannequins to represent occupants, which simplifies human features while maintaining the same surface area to mimic seated and standing positions. However, while the methodology section discusses the integration of DTM and CFD models and the rationale behind using mannequins, it does not explicitly list all assumptions related to model parameters, such as viral load, transmission rates, or specific behaviors of occupants that could affect airborne infection risk. The assumptions regarding SARS-CoV-2 emissions and its airborne transport are mentioned to be based on uncertainties and broad scientific debate, indicating that while some assumptions are published, the full extent of assumptions, especially those related to viral parameters, may not be fully disclosed.	The text does not provide specific formulas associated with the model directly within the provided excerpts. While it discusses the methodology and the factors considered in the model, such as CO2 levels, occupancy profiles, and heat gains, and proposes an hourly airborne infection rate (HAI) as a parameter, the actual mathematical formulas used to calculate airborne infection risk or to normalize viral material concentration to a human infectious dose are not explicitly mentioned.	The results and conclusions presented in the study appear to be consistent with the objectives, but methodological limitations do not allow their generalization.	**Low**

Zhuang, 2022	The description of the population (building occupants) and the interventions (ventilation adjustments based on occupancy predictions) is adequately outlined in the context of the study's objectives. However, the summary does not provide detailed demographic information about the occupants or specific characteristics of the buildings (e.g., size, layout, type of ventilation systems) which could influence the model's applicability and generalizability. The interventions, centered on optimizing ventilation for energy efficiency and infection control, are well-defined. The study clearly describes how the ABLSTM model's predictions can inform real-time ventilation control decisions, highlighting the model's utility in both pandemic and non-pandemic conditions. The decision-making schemes for ventilation adjustments based on the model's predictions are a crucial intervention for reducing infection risk and energy consumption.	The description of the autoencoder Bayesian Long Short-term Memory (ABLSTM) model used for probabilistic occupancy prediction is complete and appropriate. The methodology section outlines the model's purpose, its basis on historical occupancy data, plug loads, lighting loads, and calendar information, and its application in predicting occupant numbers for optimizing ventilation in buildings. The ABLSTM model incorporates a Bayesian framework to account for uncertainties in predictions, which is crucial for making risk-aware decisions in ventilation control under both normal and pandemic scenarios. The comparison with a conventional LSTM model as a baseline demonstrates the improvement and suitability of the ABLSTM model for the study's objectives.	Assumptions of the Model: While the study mentions considering model misspecification, epistemic uncertainty, and aleatoric uncertainty, it does not explicitly list all the assumptions underlying the ABLSTM model. Understanding these assumptions is critical for evaluating the model's applicability and limitations. For a comprehensive evaluation, the publication would benefit from a detailed discussion of all assumptions made during the model development and application phases.	The study provides some formulas related to performance metrics such as RMSE, MAPE, CVRMSE, χ-accuracy, and PICP. These metrics are essential for evaluating the model's predictive performance and its uncertainty accuracy. However, the specific formulas that define the ABLSTM model's architecture, its Bayesian framework, or how it processes input features for occupancy prediction are not detailed in the provided summary. For a thorough technical understanding and reproducibility, these model-specific formulas are crucial.	The results and conclusions presented in the study appear to be consistent with the objectives, but methodological limitations do not allow their generalization.	**Low**

Dai, 2023	The description of the population and the interventions evaluated in the study appears to be somewhat limited based on the provided excerpts. While the study clearly outlines the methodology used to simulate and analyze the dispersion of pollutants and the impact of various wind directions on this process, there is less detail on the specific population characteristics (e.g., number of occupants, their activities, or occupancy patterns within the dormitory complex) and the nature of the interventions being evaluated (if any specific interventions beyond the simulation of natural ventilation and its effects were considered). For a comprehensive evaluation of the study's relevance to real-world applications, especially in the context of preventing the spread of infectious diseases in compact living environments like dormitories, a more detailed description of the population (e.g., demographic characteristics, density) and any specific interventions or preventive measures being evaluated (e.g., modifications to building design, changes in ventilation systems) would be beneficial. This would enhance the applicability of the study's findings to developing effective strategies.	The description of the model appears to be both complete and appropriate for the study's objectives. The authors utilized Computational Fluid Dynamics (CFD) to simulate airflow patterns and pollutant dispersions in a dormitory complex, including a quarantine area and surrounding buildings. The study employed ANSYS 2020 R2 software and the finite volume method for simulations, with the SIMPLEC algorithm for pressure–velocity coupling and second-order precision discrete schemes for convection, diffusion term, and pressure difference method. The validation of the CFD model against experimental data further supports the appropriateness of the model. Therefore, the description of the model is comprehensive and suitable for investigating ventilation and pollutant dispersion in compact living environments.	While the study provides detailed information on the methodology and validation of the CFD model, there is a lack of explicit mention of all the assumptions underlying the model in the provided excerpts. CFD models typically involve assumptions related to fluid properties, boundary conditions, and turbulence modeling, among others. Although the study mentions the use of RANS models for incompressible Newtonian fluids, a comprehensive list of assumptions is not explicitly provided.	The study does mention specific formulas associated with the model, such as the governing equations in RANS models for incompressible Newtonian fluids and the equation used for grid sensitivity analysis. Additionally, the Wells–Riley model used to assess the level of infection risk is mentioned, which is crucial for linking the CFD results to potential health outcomes. However, not all equations and formulas used in the analysis are detailed, though key equations related to the study's objectives are mentioned.	The results and conclusions presented by the authors appear to be consistent with the objectives and methodology of the study. The findings highlight how different wind directions affect pollutant re-entry ratios and infection risks in the dormitory complex, with specific scenarios leading to significantly higher risks. The study's conclusions regarding the impact of wind direction on ventilation effectiveness and infection risk are supported by the CFD simulations and risk assessment models employed. The consistency between the methodology, results, and conclusions suggests a logical and coherent study.	**Low**

Liu, 2022	The description of the population and the interventions evaluated in the study appears to be adequately detailed for the purpose of the research. The population, in this case, is implied to be passengers seated within a commercial airliner cabin mockup, which is a realistic representation for evaluating ventilation systems in actual flight conditions. The interventions evaluated include: The use of two different ventilation systems (DV and MV) to understand their impact on airflow, thermal comfort, and infection risk. The impact of wearing masks by passengers as a mitigation strategy to reduce the spread of COVID-19. However, the study could have provided more explicit details about the demographic characteristics of the population (e.g., age, health status) if human subjects were involved in the experimental part, or if such characteristics were considered in the simulations. Understanding the demographic makeup is crucial as factors like age and pre-existing health conditions can influence an individual's susceptibility to infection and perception of thermal comfort.	The description of the model used in the study is comprehensive and appropriate for the objectives set forth. The study employs the realizable k-ε model for simulating airflows within the enclosed spaces of airliner cabins, which is proven to be effective and economical for such applications. Additionally, the Lagrangian method is used for simulating the transport of particles within the cabin mockup, which is crucial for assessing the risk of COVID-19 infection among passengers. The choice of these models is based on their established utility in similar contexts, indicating that the description of the model is both complete and appropriate.	While the study provides a detailed description of the model used, it does not explicitly list all the assumptions underlying the model in the provided excerpts. However, the choice of the realizable k-ε model and the Lagrangian method for particle transport implicitly carries standard assumptions associated with these models, such as assumptions regarding turbulence and particle behavior in airflow.	The study does publish formulas associated with the model, particularly those related to the assessment of COVID-19 infection risk using the Wells-Riley equation and the calculation of particle concentration. These formulas are crucial for understanding how the model translates airflow and particle transport simulations into assessments of infection risk. This indicates that key formulas integral to the model's application and the study's objectives are indeed published.	The results and conclusions presented by the authors appear to be consistent with the methodology and the data obtained from both experimental measurements and simulations.	**Low**

Kennedy, 2021	The description of the population and the interventions evaluated has limitations. The model's inputs, such as viral load, vary greatly between individual emitters, and some key information about the pathogen, like the infectious dose of SARS-CoV-2, is not known. This variability and lack of specific data mean that the infection risks reported are valid only for the specific inputs assumed and should not be taken literally. The analysis presented is narrowly focused on the potential risk of infection from a quasi-steady state virus aerosol generation through breathing, with future research needed to expand the knowledge basis on virus aerosol transmission and include sporadic aerosol generation mechanisms like coughing and sneezing.	The description of the model used, FATE, is adequately detailed for the purpose of quantifying airborne transmission and infection of SARS-CoV-2 in both single-region and multi-region settings. The model's adaptability to represent different confinement settings and ventilation networks is highlighted, along with its ability to evaluate the effectiveness of various mitigation measures such as ventilation improvements, use of HEPA filters, and wearing masks. The model is appropriately detailed for the study's objectives.	The authors have published key assumptions of the model, including the variability in viral load among individual emitters and the unknown infectious dose of SARS-CoV-2. These assumptions are critical as they directly influence the model's infection risk outputs, indicating that the results are specific to the inputs assumed and should not be generalized without caution. However, the description of assumptions related to the model's simplifications, such as the neglect of sporadic aerosol generation mechanisms like coughing and sneezing, could be considered a limitation.	While the text does not explicitly detail the formulas used within the FATE model, it does describe the model's reliance on parameters such as air changes per hour (ACH) and virus half-life, which are incorporated as linear droplet removal rate terms in the governing equations. This description suggests an underlying mathematical framework guiding the model's operation, but the absence of explicit formulas limits the ability to fully evaluate the model's mathematical underpinnings.	The results and conclusions presented are consistent with the methodology and assumptions described. The FATE model's findings, such as the effectiveness of continuous purging of room atmosphere with outside air, wearing masks, and the use of HEPA filters in multi-room facilities, align with the expected outcomes based on the model's design and the described interventions. The acknowledgment of the model's limitations and the call for future research to expand the knowledge basis on virus aerosol transmission further support the consistency and credibility of the authors' conclusions.	**Low**

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